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WHERE CAUTION IS NEEDED.

A feature of the electric traction motor which has made possible a large increase in the carrying capacity of street railways is the high rate of acceleration obtainable. The only limit here is the cost of the equipment and the comfort of the passengers. The latter is generally the ruling one. This factor alone not only shortens considerably the running time of trains when the maximum speed is fixed, but makes it possible to give a more frequent service, and thus to carry many more passengers. The results of actual practice prove this most conclusively.

But, in the endeavor to improve the service, it must not be forgotten that this high rate of acceleration may introduce a danger. When the engineer of a steam locomotive, after years of service, is transferred to an electric train, it is probable that it takes him some time to learn the characteristics of his new motor. He may not realize that, after throwing on the power, it takes but a short time for the electric train to come up to full speed. He has none of the old familiar sounds to guide him. The thumping and jerking of the piston rods and side bars is absent, and the only way of judging speed is by actual movement. This is not easy to do until one has had long practice, and for an engineer taken from a steam locomotive it must be particularly difficult. It seems probable that to this may be attributed some of the accidents to electric trains which have occurred. For example, in rounding a curve it is generally necessary to apply power to overcome the increased resistance to the train, and in approaching the curve at a low speed the motorman might, unthinkingly, throw on power, not realizing that a considerable increase in the speed of his train would take place before the curve was reached and the increased resistance encountered.

It is not impossible, moreover, that in running at high speeds with electrically hauled trains, that the motorman may misjudge his speed because of the smoothness of running and the absence of jerks. He may really be going at a much higher speed than he realizes. To prevent accidents from this cause it might be well to add to the equipment of an electric locomotive a speed indicator. This could be done without much expense, and the motorman would no longer be left to judge from his past experience, which might, indeed, be misleading.

There is another feature of the electric motor which should be impressed upon the men in charge of trains—that is, the lower the speed the greater the power which can be delivered to the motors, and therefore the greater the effort which they can develop. There is no limit here corresponding to the boiler

pressure in the steam locomotive, except, of course, the automatic switch at the power station and the equipment of the power station itself. A motor, when stalled, exerts a greater turning effort than it does at any other time—in fact, it is this feature that enables it to accelerate the train so rapidly.

DIRECTED WIRELESS TELEGRAPHY.

One of the methods of directing the electric waves used in wireless telegraphy is that described by William Marconi. In this the sending antenna is stretched in a more or less horizontal position above the ground. The effect appears to be to send out more intense waves in the plane containing the antenna than in planes at angles to it. Mr. Marconi's experiments seem to show that the waves sent out in the direction in which the antenna pointed were not as intense as those in the opposite direction. An explanation of this action of this form of antenna was given a short time ago by Dr. J. A. Fleming, and was commented upon in the ELECTRICAL REVIEW for January 19. This explanation did not seem entirely satisfactory, because, by extending the argument, it apparently could be proved that a single vertical wire would radiate uniformly in all directions. The error here is in confusing the centre of the oscillating system with the centre of a vertical wire, and when allowance is made for this the ununiform field apparently produced by the single vertical wire becomes uniform. However, the argument is just as faulty in explaining the behavior of the horizontal antenna. The fact, however, that this arrangement does set up a non-uniform radiation seems to be beyond question.

In a recent issue of the *Physikalische Zeitschrift* an interesting account of a similar investigation is given by K. E. F. Schmidt. Mr. Schmidt found that an appreciable directive action was obtainable by adding a horizontal section to the vertical antenna, but his form of antenna differs somewhat from that used by Marconi. The former used a horizontal wire attached to the oscillator by means of a short vertical wire. Mr. Schmidt, on the other hand, places his oscillator between the vertical and the horizontal members of his antenna. This arrangement apparently has the effect of sending the most intense waves in the direction in which the horizontal member points, and the difference in the intensity of the radiations in these two directions is considerably greater than that obtained by his predecessor.

The scale upon which the experiments were conducted will be indicated by a few figures. The horizontal wire varied in length from eighteen to twenty-four metres. It was connected to a vertical wire somewhat greater in length, placed sometimes in a vertical position and sometimes inclined at an angle of seventy degrees to the horizontal. The receiving wire was about ten metres in length, was vertical, and was placed about 150 metres distant. In some cases the intensities of the radiations set up in the direction in which the horizontal wire pointed were almost twice as great as those sent in the opposite direction.

So far as the form of the antenna alone is concerned, it does not appear why there should be such opposite effects as compared with Marconi's experiments, but it is probable that the method of connecting the oscillator has considerably more to do with it. In Marconi's experiments the two portions of the antenna were connected in series, so that the oscillations passed from one to the other. In Mr. Schmidt's experiments these members were in parallel, so that the oscillations in the portions of the antenna should be more nearly in phase. Such a difference in phase would easily account for the difference in the results. It would also be in accordance with the explanation offered by the reference given above—that is to say, that the two portions of the antenna act with the earth as two oscillating systems somewhat out of phase, and therefore the waves set up by the two cause interference. The relative phases of the two oscillations will, of course, determine the directions in which reenforcement and interference take place. A complete investigation of the effect of varying the proportions of the two members of the antenna would throw much light on the subject.

THE ELECTRIC MOTOR IN THE OFFICE.

One of the most remarkable things about the small electric motor is the facility with which it may be applied to every variety of machine driving. In the majority of cases the motor is the least conspicuous part of the combination, even in applications to very small machines. The field of usefulness of the small motor is constantly broadening, and many lines of work where tedious hand labor was the rule have been improved and cheapened in operating cost by the motor designer. Many of these motors can be connected to an ordinary lamp socket and are quite as reliable in operation as much larger machines. Their design and construction bear evidence of the same careful planning with respect to the conditions to be met and the same use of organized shop methods in shaping the material which have been largely responsible for the success of high-powered motors.

A recent field of small motor application may be found in the modern business office. A large number of special labor-saving appliances have been developed within the last few years with particular regard to lessening the routine burdens of office work. Along with improved filing and card systems have come machines for addressing and folding letters, for duplicating and copying all sorts of typewritten, printed and written matter, and for binding, stitching, numbering, perforating, punching and creasing papers *en bloc*. A large number of these machines were shown in operation by small motors at the recent Office Appliance Exhibitions in New York and Boston.

In general, the amount of power required to run one of these special machines is so small that the cost of operation is almost nominal. The great advantage of the motor drive arises from the steady production which is almost impossible with hand operation on account of the fatigue attending the use of the crank for an hour or two. It is not, as a rule, contended by the makers of this light office machinery that a larger volume of work can be turned out in a short time on account of the motor drive, but it generally works out that where the volume of correspondence, or other matter to be handled, is large, the

continuous operation of the motor produces a greater output than would be the case with hand working. The attention of the office employé is not in any way distracted by the necessity of keeping the machine in motion if a small motor be attached.

An automatic paper-folding machine operated by a one-twentieth horse-power, 110-volt motor will do the work of eight persons folding by hand, and it is especially adapted to the folding of circular letters, price lists, railroad tariffs, time-tables, statements, etc. Such a machine will fold from 6,000 to 7,000 letters in an hour, while the cost of operation scarcely exceeds that of running a single sixteen-candle-power incandescent lamp. The annual charges on such a machine, which costs about $175 complete with the direct-connected motor, are too small for any large business house to consider, in comparison with the saving in time effected. These machines have been found particularly useful in brokers' offices where market letters have to be mailed to distant customers between the hours when the stock exchange and the brokerage houses close. It is estimated that the maximum cost of folding by these machines is from three to five cents a thousand sheets, against from twenty to forty-five cents by hand labor.

The motor-driven letter copier is valuable to business houses having a daily outgoing correspondence of four or five hundred letters or over. Such a machine costs only about $85 in the larger sizes, complete with motor, and it is available for making copies of telegrams, statements, invoices, estimates, sketches and many other kinds of papers, as well as letters. About one-tenth of a horse-power is required for this service, and the saving in time with large firms is noteworthy. The motor may be plugged into any lamp socket carrying the proper kind of current, and the most economical speed for the work in hand retained by the use of a small field rheostat.

Another machine, which is generally operated by a one-and-one-fourth horse-power motor, is designed for producing from 800 to 1,200 imitation typewritten letters an hour, with different addresses and *fac simile* signatures. The cost of the outfit, about $300, is a small matter in the case of a large business house, and the expense of operation is slight. Numbering and creasing machines, used more generally in bookbinderies, require about one-eighth of a horse-power each; perforating machines about one-fourth of a horse-power, and punching or stitching machines about one-half horse-power each in the larger sizes. Paper-stock two inches thick can be stitched with a one-half-horse-power motor without any serious slowing down of the speed. Many of these machines are supplied with rawhide pinions and steel gears, the motors being mounted directly on the frames, and they produce very little noise in operation.

The fan motor and the small motor for driving cash carrier or basket conveyer systems are too familiar to require comment at this time. Adding these to the special outfits mentioned above there would seem to be no lack of electrically driven labor-saving devices to facilitate the work of the large business office. The cleanliness of the electric drive is as valuable in the office as in any other field where dirt and grease are inadmissible.

THE BLIGHT OF MUNICIPAL OWNERSHIP.

Now that there is no municipal or state election impending less is heard about the advantages of municipal or government ownership of public utilities. Nevertheless, certain happenings abroad have led a number of leading newspapers to comment upon the disadvantages, and even the disastrous results, which have followed from this policy.

Speaking recently of the situation in London, the New York *Times* points out what it designates as the blight of municipal ownership. This, the leading city of the world, is supplied from about a score of municipal plants. The situation is most unsatisfactory, and efforts have been made for several years past to alleviate the troubles by creating a large municipal system covering the entire city and supplying power from large, modern, efficient stations. This plan contemplates the expenditure of about $47,000,000. As yet, however, little progress has been made, and even with the prospect before it of so much work, a large electrical establishment has found it necessary to mark $5,000,000 from the capital of its plant, although this is a branch establishment of a company which has been most successful in the United States. Thus, not only has municipal ownership retarded the development of the city, but is injuring the growth of industries which are of exceeding importance to the country.

In Paris also there is a sad situation. Here, however, it is the telephone that is the source of complaint. In a recent issue the New York *Sun* discusses the situation there and points out the evils. There are over 30,000 telephone subscribers organized in two associations which are fighting for much-needed reforms. The equipment is antiquated and unsatisfactory, and the service is worse than poor; in fact, during the noon hour no attempt is made to keep the exchange in operation. From all accounts the service could hardly be worse. To remedy this $6,000,000 is necessary. The telephone department has a credit of about $100,000, and it is said that this is all that is available for installing a modern equipment such as is being demanded by the subscribers. The telephone situation in Paris is thus not only miserable, but it serves what, by American standards, would be considered a very small part of the population. In England the same is true of practically all the electrical industries. There are only about one-third as many electric light plants as there should be, and only 3,000 miles of electric railway, where there should be 14,000 by our standards.

However, every month or so we learn of a city or town voting in favor of a lighting plant operated under official supervision and control. Some, already established, have apparently been well managed and are successful. It is but natural that taxpayers should reason that a private corporation is not a philanthropic institution, and that, therefore, there must be a profit in the business; why, then, should not the taxpayer enjoy that profit? But there seems to be a difficulty in organizing the municipal working forces, and in this direction alone there is a considerable loss in efficiency.

The New York & New Jersey Telephone Company.

The twenty-fourth annual report of the New York & New Jersey Telephone Company to its stockholders for the year 1906 is given below. The results of the company's operations during the year, and its financial condition at the end of the year, are shown in the following statements:

STATION STATEMENT, 1906.

	In State of New York	In State of New Jersey	Total
In service Jan. 1, 1906	59,476	52,573	112,049
Net gain, 1906.....	10,120	9,273	19,393
In service Dec. 31, 1906	69,596	61,846	131,442
Percentage of gain....	17.0	18.0	17.3

DETAILS OF EARNINGS AND EXPENSES, 1906.

EARNINGS.

Exchange service	$3,549,697.30	
Pay stations	881,221.52	
Toll service	2,650,969.41	
Leased lines and instruments	33,719.70	
Real estate	232,579.27	
Other sources	98,959.72	
		$7,447,146.92

OPERATING EXPENSES.

General expense and taxes	$852,960.84	
Procuring and handling traffic	1,934,905.22	
Maintenance and reconstruction	2,357,086.35	
Instrument rentals ...	346,606.21	
Real estate expenses ..	168,094.98	
		$5,659,653.60

Earnings over operating expenses...	$1,787,493.32
Interest charges	86,629.29
Dividends declared	1,272,797.00
Total interest charges and dividends	1,359,426.29
Surplus for the year.....	428,067.03
Surplus January 1, 1906.....	3,997,828.42
Surplus December 31, 1906.....	4,425,895.45

CAPITAL STOCK AND BONDS.

"From the issue of stock at par the treasury of the company received during 1906, from the 1905 offering $632,225, and from the 1906 offering $1,719,100, a total of $2,351,325. The 1906 offering was limited to ten per cent of the then outstanding stock. The proceeds from these sales being insufficient to provide for the large additions made to the property and plant during the year, the additional funds required were raised by loans upon the company's notes. The outstanding bills payable at the close of the year amounted to $2,050,000. To pay these loans and provide for 1907 construction the board of directors in December, 1906, authorized an offer to stockholders of new stock at par to the amount of thirty-three and one-third per cent of the then outstanding stock, or $6,310,166.66.

"Dividends were declared during the year at the rate of one and one-half per cent quarterly, with an extra dividend of one per cent at the end of the year, making the annual rate seven per cent. The board of directors has decided that hereafter, earnings permitting, dividends shall be declared at the same annual rate of seven per cent, but at one and three-quarter per cent quarterly instead of as heretofore, so as to distribute the total annual dividend payments evenly throughout the year.

"The operations of the sinking fund resulted in the redemption during the year of $17,000 of the company's general mortgage bonds, leaving an outstanding bonded debt at the end of the year of $1,233,000.

"The outstanding stock and bonds of the company are represented by property at a fair and legitimate valuation; franchises, or rights granted by the public for the use of the public highways, have not been capitalized. Ample provision in reserves and surplus has been made for extraordinary depreciation and contingencies.

RATES AND GROWTH IN STATIONS.

"As a result of frequent and systematic reductions, the average earnings per station have decreased during the past ten years approximately fifty per cent. Although a little more than one-half of the total decrease was made during the first five years of the period, the average has declined in every year, the decline being fairly uniform throughout the entire period.

"During the same period there was a remarkable increase in the number of stations, as shown by the following table:

At End of Year	Stations in Service	Gain During Two Years	Percentage of Gain
1896	14,333		
1898	22,065	7,732	53.94
1900	35,176	13,111	59.42
1902	53,184	18,008	51.19
1904	80,324	27,140	51.03
1906	131,442	51,118	63.64

"The total gain for the ten years was 117,109 stations, or about 817 per cent.

TERRITORY AND PLANT.

"The territory operated by the company is, as a telephone field, one of the most important in the world. It embraces all of Long Island and Staten Island, including three of the five boroughs of New York city, and all that part of New Jersey which is directly tributary to New York city. It covers about 4,500 square miles, and contains a population estimated at the present time at 3,600,000.

"In the larger centres, especially where the principal lines are underground, the company has acquired real estate and constructed buildings for use in the operation of its system. Of the buildings now occupied by the company, thirty-three are owned by it, twenty-five of which are modern fireproof structures especially adapted to the peculiar needs of the business. Fourteen of these fireproof buildings are on Long Island and Staten Island, while eleven of them are in New Jersey—two in Newark, two in Jersey City, and one each in Paterson, Passaic, Montclair, Orange, Hoboken, Elizabeth and Morristown. At the end of the year three other fireproof buildings were in course of construction and nearing completion. There was added to the real estate investment account during 1906 the sum of $477,945.66; the total of such investment at the end of the year was $2,683,719.41.

"In twenty-two of the principal cities served by the company the central office and station equipment is of the standard common-battery type. . . . There was expended during the year for central office equipment $731,115.82, and for station equipment $715,436.34.

"Great additions were made to the line plant during the year, particularly to the underground conduit and cable systems. The new investment for aerial plant was $1,313,837.67, and for underground plant $2,058,305.22. Not only has the company constructed extensive underground conduit systems in the larger places in which it operates, such as Brooklyn, Jamaica, Newark, Jersey City, Hoboken, Paterson, Passaic, Elizabeth, Montclair, the Oranges, Long Branch and Asbury Park, but it has also followed this form of construction in many other parts of its territory, having at the end of the year no less than fifty-six underground networks in various cities. The principal city systems are also connected with each other by underground interurban systems. In Long Island underground lines extend from the Brooklyn exchange area to Coney Island, to Far Rockaway (except for a few miles), to Flushing, to Jamaica, and to and beyond Hempstead within a few miles of Babylon. In New Jersey, the cities of Newark, Jersey City, Bayonne, Paterson, Passaic, the Oranges, Montclair, Bloomfield, Rahway, Perth Amboy and New Brunswick are connected together by means of a general system of underground conduits and cables. The exchange centres on Staten Island are also connected by underground and submarine cables to the general system of underground trunk lines in New Jersey. Indeed, over 100,000 of the total number of stations operated, or more than seventy-five per cent of the whole, are in centres which are joined together by an underground trunk-line system.

"A very considerable part of the traffic passing over the trunk lines of your company is destined to or received from points in the territory of the New York Telephone Company. The extensive underground systems of your company are connected directly by underground and submarine cables to the very comprehensive underground systems of the New York Telephone Company. The combined systems of the two companies form by far the largest underground telephone plant in the world."

The New Steam Turbine Plant of the Potomac Electric Power Company, Washington, D. C.

ONE of the latest and most modern power plants of large size, employing steam turbines as prime movers, has just been completed for the Potomac Electric Power Company, of Washington, D. C. It was designed and constructed by J. G. White & Company, of New York city, under the direct supervision of L. E. Sinclair, general superintendent of the Potomac Electric Power Company. The plant is located near the Bennings' Road bridge, on the eastern bank of the Anacostia river, just outside of Washington. It will supply light and power for the city of Washington, and for a large part of the street railway system.

The layout of the building is similar to many of the modern prominent turbine-generator stations. The boiler room is arranged at right angles to the generating room, while the switching apparatus is located in an annex, running along the entire length of the generating room. The boiler room, which is 164 feet long by 180 feet wide, is arranged so as to accommodate four rows of boilers, thus forming two firing aisles. There are at present installed sixteen boilers, while space is provided for eight additional. There are three stacks (one for every eight boilers) and two suspended steel coal bunkers with a capacity of 650 tons each. The boiler house is provided with a basement fourteen feet high; the floor of which is flush with the main generating room floor. It contains, besides the coal and ash-handling plant, a repair shop, store room and a locker and toilet room.

Of more importance, however, is the machinery in the boiler room basement. Here are installed two exciter units, the boiler feed pumps, oil pumps and two house pumps, as well as the oil filtering tanks and testing tanks. The space occupied by this machinery is separated from the rest of the basement by a hollow concrete block wall, thus forming an extension of the main generating room floor. This is possible owing to the fact that the division wall between the generating room and the boiler room does not start from the main operating room floor, but starts some fourteen feet above and is carried on I-beams.

The generating room, which is 164 feet long by 45 feet wide, has been laid out to accommodate three 5,000-kilowatt and two 2,000-kilowatt turbines. At present there are, however, only two 5,000 and two 2,000-kilowatt turbines to be installed. The annex for the switching compartments, offices, etc., is 15 feet wide by 164 feet long.

Owing to the condition of the soil, it was found necessary to drive piles for the greater part of the footings of the engine room, walls, columns, etc. These piles are of the Raymond concrete system and are from thirty to forty feet in length, while the condition of the turbine foundations itself, owing to their depth, did not require any piling. This was due to the peculiar arrangement of the condensing water intake and condensing water discharge tunnels running directly through the turbine foundations, as will be seen by the accompanying illustrations. This arrangement materially reduces the amount of concrete necessary for the foundations, and, at the same time, gives a most satisfactory arrangement for obtaining the circulating water. Both the intake and discharge tunnels have an area of forty square feet each.

The footing of the turbine foundations is calculated for a bearing power of 1.8 tons per square foot of soil. In order to prevent uneven settlement, between the different turbines, old rails have been embedded in the concrete of the tunnel, throughout the length of the building. As the entire building covers an area of 29,520 square feet, and as the normal output of the plant is 19,000 kilowatts, 1.52 square feet is taken up per kilowatt. The structural steel required for the building amounts to about 800 tons.

Up to the basement floor, all wall and column footings are made of concrete, while the superstructure consists of a self-supporting steel skeleton frame. The walls are of hollow concrete blocks, self-supporting, with the exception of a few of the lighter walls. These hollow concrete blocks are made by the Lake Stone Company, of Washington, D. C., and are of uniform size, being three feet by one foot by one foot. However, there are some special design blocks, such as were required by the door and window lintels and sills. Some of the lintels have a span of twelve feet and are reenforced by three-quarters-inch rods. In fact, all lintels are reenforced. The pilasters and cornices of the building are well designed and the architectural features of the entire structure gives a pleasing appearance and harmonizes with the tall chimneys, also made of concrete.

The coal is brought to the plant on railroad cars and is stored in the yard or dumped into pockets at the side of the boiler rooms, crushed and then delivered to the top of the bunkers in the boiler room by means of bucket conveyers. From here the coal is distributed into bunkers by means of two belt conveyers of a capacity of forty tons per hour each. Ashes may be removed, either by railroad cars or by teams. The ashes are collected in reenforced concrete hoppers suspended under the boilers, from where they are removed on an industrial railway system and dumped into a receiving hopper feeding the above-mentioned bucket conveyers, in order to store same in ash hoppers arranged between the coal bunkers and the end wall of the boiler room. These hoppers are made of reenforced concrete and have a storage capacity of approximately fifty cubic yards each.

EQUIPMENT.

At present there are installed sixteen boilers, arranged in four rows, two boilers forming one battery. All boilers are of the Babcock & Wilcox make, having a heating surface of 6,040 square feet, designed for 175 pounds working pressure and equipped with superheaters of 1,180 square feet heating surface, capable of superheating the steam to 150 degrees Fahrenheit. The boilers are provided with Roney mechanical stokers each having a grate area of 111.8 square feet. The front of the boilers are faced with white enamel brick.

The flue connections are made on the top of the boilers, four boilers joining in one breeching, thus giving two breechings for each chimney. Each boiler is provided with a hand damper, while the four main flues are equipped with dampers operated by two automatic regulators.

The chimneys are of the Weber concrete-steel type and are 200 feet in height above the basement floor, 183 feet in height above the grates, 163 feet in height above the flue openings, with an internal diameter of twelve feet.

As before stated, there are three chimneys, one of which is kept in reserve for the eight boilers which are to be installed.

Between the boilers and the chimneys there are installed two Warren Webster

open feed-water heaters, each being capable of heating 200,000 pounds of boiler feed-water up to from 80 degrees to 205 degrees Fahrenheit per hour.

In order to make up the loss, caused by leakage, etc., two make-up tanks have been installed in the boiler room, each having a storage capacity of 25,000 pounds of water. For this purpose there are installed two house pumps.

The boiler feed-water is supplied by two horizontal duplex pumps, 16 by 10¼ by 16 inches. An additional pump will be installed with the full equipment of the plant. These pumps work upon a six-inch header ring system from where the branches lead to the boilers. The arrangement is such that either pump may supply water to any of the boilers. Branch connections to the boilers are so centrally located that the water tender may operate the valves of eight boilers from practically one point. All steam leads from the boilers are seven inches in diameter, which are connected to the main header system by means of flexible bends, as will be seen in the accompanying illustration. The largest size of this header is fifteen inches outside diameter. The pipes are all made of steel with the exception of fittings, which are of semi-steel. All pipes have been provided with the loose type flange, known as the Van Stone flange. From the header the branches lead to the turbines, the size of which are as follows: ten-inch pipe to the 2,000-kilowatt turbines; twelve-inch pipe to the 5,000-kilowatt turbines.

These sizes of the twelve-inch pipes, have been chosen by the designing engineers, due to the use of superheated steam, which enables a greater velocity than saturated steam. As the turbines operate with seventeen pounds of steam per kilowatt, and as the volume of superheated steam at 150 degrees Fahrenheit is practically thirty per cent greater than that of saturated steam at same pressure (175 pounds), the velocity in the steam pipes will be approximately 7,800 feet per minute.

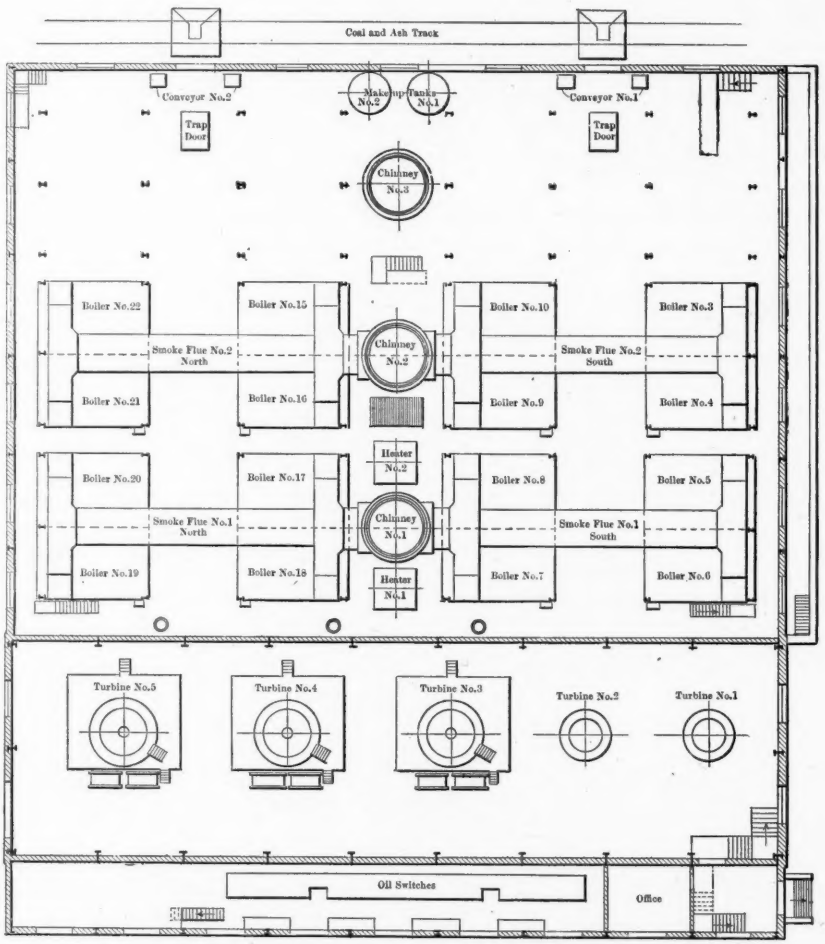
No separators have been installed in the pipe-line, but provision is made to drain the system, for which purpose four one and one-quarter-inch traps have been located in the basement of the boiler room. The return water is fed into the feed-water heater. A separate six-inch steam header has been installed in the basement for the auxiliary machinery. This header runs the entire length of the plant and draws its steam at three points from the main header, by means of six-inch connections. This auxiliary header is also provided with a drip system of two three-quarters-inch traps. All steam piping, both main and auxiliary, is covered with eighty-five per cent magnesia.

The turbines are of the Curtis base-condenser type; the two 2,000-kilowatt units being four-stage and the 5,000-kilowatt units five-stage. The alternators are four-pole, twenty-five cycle, and designed for 6,600 volts. The turbines run at 750 revolutions per minute.

The first turbine installed was a 5,000-kilowatt unit, which has been in operation since the early part of December. The cooling surface of the condensers for these 5,000-kilowatt turbines is 20,000 square feet. The circulating water is drawn by means of a twenty-four-inch steam-driven centrifugal pump. The vacuum pumps are of the rotative single-stage type, also steam-driven. The hot-well pumps, which are located in the hot-well pits, five feet nine inches below the main operating room floor, are vertical, two-stage, centrifugal pumps and are the only pumps motor-driven. The auxiliary machinery is grouped around one main turbine generator so as to form the most compact unit system. The 5,000-kilowatt unit, to be installed in the future, will be arranged in the same manner.

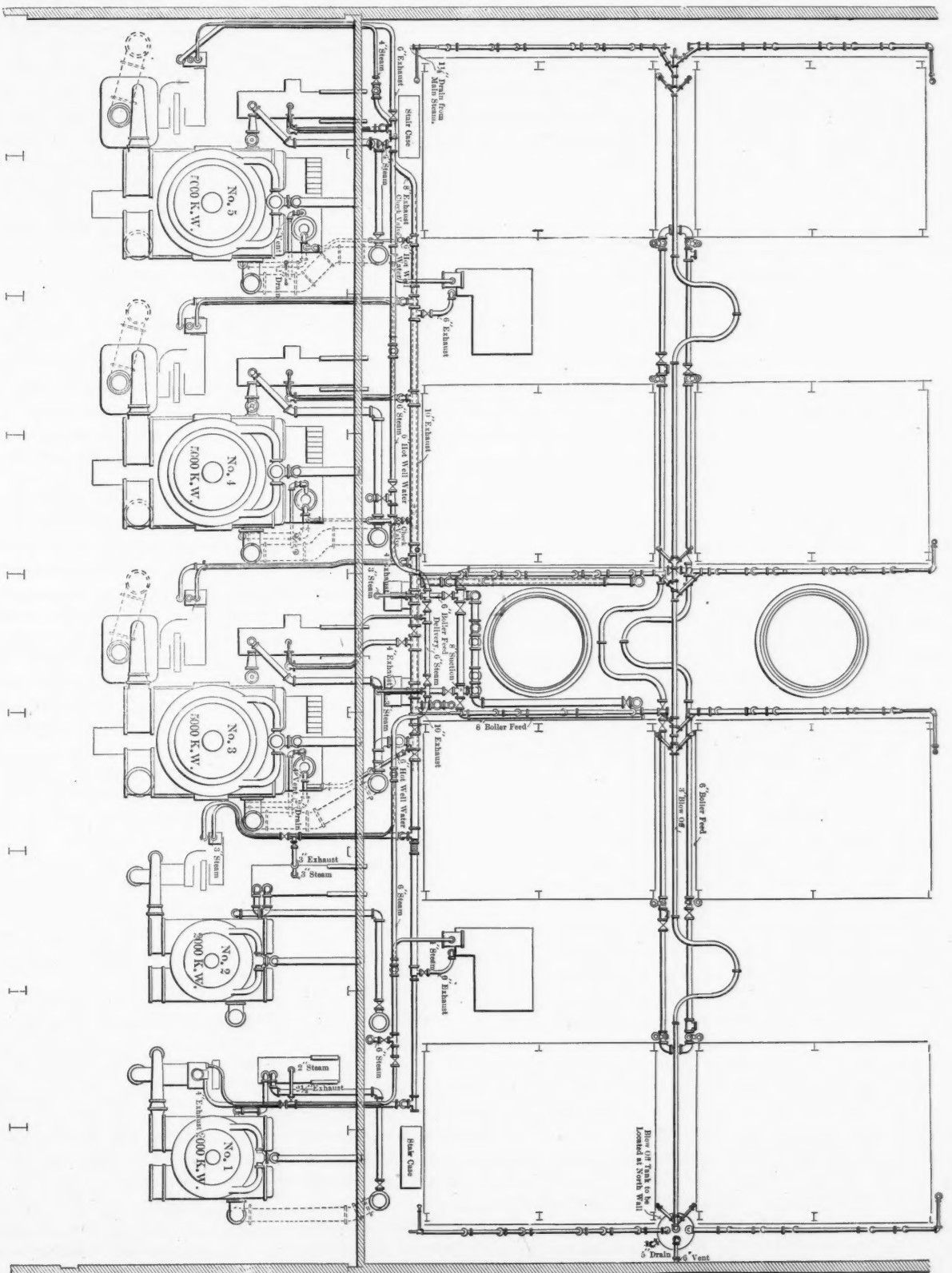
The 2,000-kilowatt turbines, which will be installed, are not new and are at present in operation in the company's existing power plants. One of these units is that which has been exhibited by the General Electric Company at the World's Fair, St. Louis. It is provided with a base-condenser, while the other unit has a separate condenser, but will, however, be re-designed for the base-condenser type, in order to have the entire plant equipment uniform. The auxiliary machinery of these turbines, such as the circulating water pumps, hot-well pumps, etc., will be taken out of the existing plant. Only one of the dry vacuum pumps will be replaced by a new one.

The atmospheric exhaust pipe leads to



FLOOR PLAN SHOWING ARRANGEMENT OF STEAM AND ELECTRICAL EQUIPMENTS, POTOMAC ELECTRIC POWER COMPANY, WASHINGTON, D. C.

a tunnel under the generator room floor into the boiler house where the riser extends through the roof. These exhaust pipes, which are twenty-four inches in diameter on the 5,000-kilowatt units, are provided with a relief valve. The hot-well pumps discharge into a common header, which leads to the two heaters. The discharge from the hot-well pump is provided with a gate valve and a check valve, in order that, should one pump fail to work the water of the other pump may



South Wall

GENERAL ARRANGEMENT OF BOILERS AND GENERATING APPARATUS, AND LAYOUT OF PIPING.

not enter the pump not in operation. The suction of the vacuum pump is provided with an angle globe valve so that in case of an emergency the turbine operates on an atmospheric exhaust line; this pump may be repaired, if necessary. The discharges of the dry air pumps are connected to the exhaust risers above the relief valve. The exhausts of all auxiliary machinery discharge into one common header, which leads to the open feed-water heaters.

There are at present installed three step-bearing pumps to supply oil to the various turbines; arrangement is made for one pump of this kind. The return oil is brought back to a collecting tank, from where it is drawn by an auxiliary oil pump and pumped into oil-filtering storage tanks, each having a capacity of 1,600 gallons. One filtering tank and one auxiliary pump are at present installed.

There are installed two 100-kilowatt, 125-volt, engine-driven exciters, which are of sufficient capacity to supply the necessary current for the entire plant. These exciter-units are located, as previously stated, in the basement of the boiler room.

The switching room, as previously stated, is fifteen feet wide and runs the entire length of the generating room. This annex is three stories. The first floor is flush with the generating room floor and contains the manholes for the generator leads and the outgoing cables, which are arranged in double tile ducts, on the side of the wall, from whence they lead under-ground to the various substations. Here are also installed the generator field rheostats, while at one end is located a toilet room. Some nine feet five inches above this floor is a gallery containing the oil switches. The oil switches control the generators and the outgoing feeders, together with two bus-sectionalizing switches. These switches are of the cellular type, each pole being mounted in a separate concrete compartment, arranged in one row. Directly back of these cells are located the bus-bar compartments. The static discharges and disconnecting switches are located between the bus-bar compartments and the wall. The switches are located in brick compartments. The second gallery, which is located above the former, contains the switchboards. The generator switchboard is made up of five panels (one for future use), while the exciter switchboard is made up of two panels, each sixteen inches wide. The feeder switchboard is made up of nine panels, each sixteen inches wide. Three of these panels are for future equipment. The switchboards are made of black enameled slate of dull finish, supported by a pipe framework and containing all controlling switches, indicating lamps, instruments, etc. The entire switching compartments are separated from the main generating room by a division wall, which is provided at the upper switchboard gallery with large openings in order to overlook the generating room.

In addition to the main station just described the Potomac Electric Power Company has erected four new substations to take care of the increasing low-tension lighting, railway and 2,400-volt lighting loads.

Taken in order these substations are: No. 2, No. 10, No. 11 and No. 12.

Substation No. 2 is located at No. 450 Washington street, N. W., adjoining the old substation No. 2. It is 100 feet in length by fourteen feet eight inches in width and one story in height. The building is of steel, brick and reenforced concrete for roof and floors. This station is designed for 6,000-kilowatt capacity and there are installed at the present time two 1,000-kilowatt rotary converters with two 1,100-kilowatt, three-phase transformers. These transformers are equipped with dial switches so that the voltage on the direct-current side of the rotary transformers can be varied. This station is to be the principal substation and there has been installed a number of type H-3 oil switches for automatic remote control. The current is brought to this station from the main power station and is distributed to other small substations through the above-mentioned switches. There is one type H switch controlling the apparatus in the substation while the oil switches that control each rotary separately are of the K-4 type and are non-automatic, it being the intention in case of any trouble inside of the station that the H type switch shall protect the substation as well as preventing any of the other lines being disturbed due to the trouble.

This station is also equipped with a large size three-wire lighting switchboard, which is connected to a storage battery located in the adjoining building which can be used either on the railway or lighting bus.

Next in order is Substation No. 10, located in the alley between H and I, Fourteenth and Fifteenth streets, N. W. It is eighty-six feet long and forty-five feet wide and two stories in height. This building, with the exception of the walls, which are brick, is entirely of concrete. A ten-ton traveling crane on concrete girders is provided for the handling of apparatus. This station is designed for 5,000-kilowatt lighting capacity to feed into the Edison three-wire system and is equipped with two 500-kilowatt induction motor-generator sets and also a balancer set with a capacity of seventy-five kilowatts. This station is provided with an air duct and the foundations are laid out so that either rotary transformers or motor-generators can be installed.

The second story is laid out for a storage battery of 250 cells, and special attention has been given to the floor of the battery room to insure its being practically acid proof. It is designed to drain both ways of the building so that it can be washed down at any time. The floor is built of acid-proof brick laid in boiling pitch with three to eight-inch joints, which were filled with hot pitch. This room is well ventilated and lighted and with practically no metal to be attacked by fumes and is separated from the end cell switch rooms and other rooms by cement partitions. The controlling apparatus is of the same type as is used at Substation No. 2, except that the motor-generator sets are started through compensators.

Substation No. 11 is located at Thirteenth and D streets, N. E. This building was remodeled from an old office building into the present substation. It is eighty feet long and thirty feet wide and one story in height. This station is designed for three 500-kilowatt rotaries and to be used entirely for railway work, and feeds into the ends of four roads whose extreme easterly lines are in the vicinity of this substation. This apparatus is controlled by type H-3 automatic, remote control oil switches. The rotaries are started up from the alternating-current end through taps that have been brought out from the transformer for that purpose.

Substation No. 12 is located in the old steam-power station at Thirty-third and K streets, N. W. The apparatus is located in the northwest corner of the building and two 500-kilowatt rotaries for railway work and one 500-kilowatt frequency-changer set, from 6,600 volts to 2,400 volts for alternating-current lighting in that territory, are being installed. It is the intention that in case anything happens to this substation that the steam station can be gotten under steam at very short notice, and men are to be retained who are familiar with the steam operation.

Besides equipping the above substations with the apparatus mentioned, one 1,000-kilowatt frequency-changer set for the purpose of supplying 2,400-volt commercial lighting has been installed in a station at Fourteenth and B streets.

MAGNETIC OSCILLATIONS IN ALTERNATORS AND THEIR BEARING UPON THE DESIGN.[1]

BY GLADSTONE W. WORRALL.

The machine employed in the present investigation was a three-phase, mesh-connected alternator with rotating armature, four poles, forty-four teeth, speed 1,200 revolutions per minute potential difference on open circuit 159 volts. Full load current in mesh fifteen amperes. Two armatures were experimented upon similar in every respect, except that the slots of one were open, and the other closed, and the size of wire employed in the latter armature was slightly smaller than that employed in the former so as to allow of the same number of conductors with the same width and depth of slot. The dimensions of slots are given in Fig. 1.

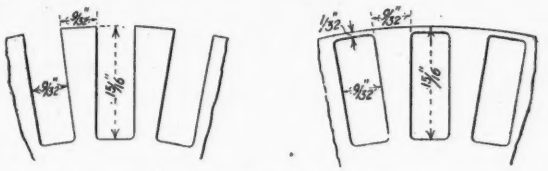


FIG. 1.—SHAPE OF SLOT.

The pole-pieces and limbs of the machine were laminated, but alternate laminations were cut short, so as to fringe the pole tips.

The oscillations were observed by means of the electromotive forces induced in certain search coils, the positions of which are shown in Fig. 2.

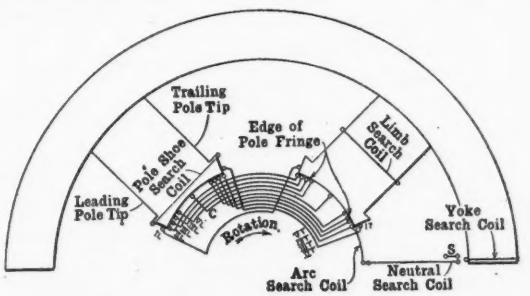


FIG. 2.—POSITION OF SEARCH COILS.

The electromotive forces induced were photographically recorded by means of a Duddell high-frequency double-oscillograph and revolving-film camera.

The machine was run on open circuit and on non-inductive and inductive loads, in each case both half and full.

OSCILLATIONS ON THE POLE-FACE DUE TO THE ARMATURE TEETH.

It was found in a previous investigation that a magnetic oscillation consists of two movements of the flux; these movements are one in the same direction as the motion of the armature, the other in the opposite direction. The former appeared to be due to hysteresis in the teeth, and was described as the "drag," the latter was a movement across the slot, and was described as the "flash." In the present investigation these observations were confirmed.

The waves of electromotive forces induced in the search coils of the previous investigation were somewhat irregular in shape, but those observed in the present case with the different type of machine were fairly regular, as will be seen later on by reference to the diagrams. It may be here recalled that the area of a half wave of electromotive force represents the magnitude of the moving flux, and that the flux due to a "flash" is in all cases equal to that due to a "drag." In Tables I and II these values are expressed as a percentage of the flux entering a tooth when the latter is under the search coil.

The high percentages given in the table for the oscillating fluxes indicate the extent to which they are bunched in the tips of the teeth, and the same table shows that the magnitude of the oscillating flux at any given point on the pole-face varies with the load.

The duration of the movement of the flux during the "flash" was, under all circumstances in which the slots were open, equal to that during the "drag."

But the electromotive force induced during a "flash" was, under the same circumstances, greater than that during a "drag," although, as has been stated, the fluxes moving in the two cases were equal. This apparent anomaly is accounted for by the difference in shape between the half wave due to a "flash" and that due to a "drag." Fig. 3 shows the wave forms of these electromotive forces for both open and closed slot.

TABLE I.

FLUX MOVING AT VARIOUS POINTS OF THE POLE-FACE EXPRESSED AS A PERCENTAGE OF THAT ENTERING A TOOTH ON OPEN CIRCUIT —OPEN SLOTS.

Coil.	Open Circuit.	Non-Inductive Load.		Inductive Load.	
		Half.	Full.	Half.	Full.
I.L	2.9	4	4.8	4	2.6
II.L	16	11	16	17	15
III.L	57	44	44	48	48
IV.L	37	31	44	37	36
V.L	58	37	44	58	44
C	46	40	56	46	40
V.T	56	50	53	66	42
IV.T	37	40	53	48	35
III.T	41	46	58	62	52
II.T	24	24	32	28	20
I.T	3.4	2.6	5.3	4.4	4

OSCILLATIONS IN THE INTER-POLAR SPACE DUE TO THE TEETH.

It was observed that considerable oscillations occurred in the neutral coil. It was thought that these might be due to leakage flux across the inter-polar space. To determine this a small search coil S (Fig. 2) was employed.

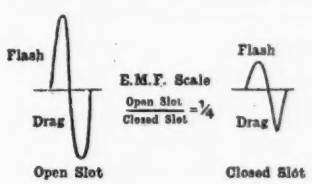


FIG. 3.—ELECTROMOTIVE-FORCE WAVE IN SEARCH COIL III.L ON OPEN CIRCUIT.

The search coil was placed first at the yoke side of the neutral coil, but no oscillations due to the teeth were observed in it; then at the armature side of the neutral coil, and oscillations were observed in it which in magnitude were almost equal to those in the neutral coil itself. It thus appeared that the oscillations were not due to the leakage flux, at least mainly, but were produced directly by the armature teeth in the neutral plane.

TABLE II.

FLUX MOVING AT VARIOUS POINTS OF THE POLE-FACE EXPRESSED AS A PERCENTAGE OF THAT ENTERING A TOOTH ON OPEN CIRCUIT—CLOSED SLOTS.

Coil.	Open Circuit.	Non-Inductive Load.		Inductive Load.	
		Half.	Full.	Half.	Full.
I.L	.56	1.2	1.3	.66	.66
II.L	3.2	2.8	2.8	2.8	2.6
III.L	5.7	4.2	3.4	5.7	5.0
IV.L	2.6	2.1	2.6	2.6	2.0
V.L	3.7	3.7	2.8	1.2	3.7
C	1.5	3.3	3.3	1.3	1.5
V.T	3.3	4.1	3.3	4.1	3.7
IV.T	2.4	3.7	4.4	1.6	1.6
III.T	4.9	5.6	5.0	4.4	6.2
II.T	2.1	2.1	3.2	2.1	2.6
I.T	.9	1.6	1.2	.66	.66

In it; then at the armature side of the neutral coil, and oscillations were observed in it which in magnitude were almost equal to those in the neutral coil itself. It thus appeared that the oscillations were not due to the leakage flux, at least mainly, but were produced directly by the armature teeth in the neutral plane.

The explanation of this phenomenon may be that some of the main flux, in-

[1] Abstracted from a paper read before the Manchester section of the Institution of Electrical Engineers of Great Britain, February 5.

stead of penetrating into the armature below the slots, passes from pole to pole alternately through tooth and slot, and that the flux when passing through a tooth is concentrated in the tooth, but when passing through a slot not only fills the slot but spreads out above the armature. The magnitude of these oscillations in the case of open slots was approximately the same on load as on open circuit, and in the case of closed slots the same equality was maintained, except on inductive loads, when their magnitude was greater than on open circuit.

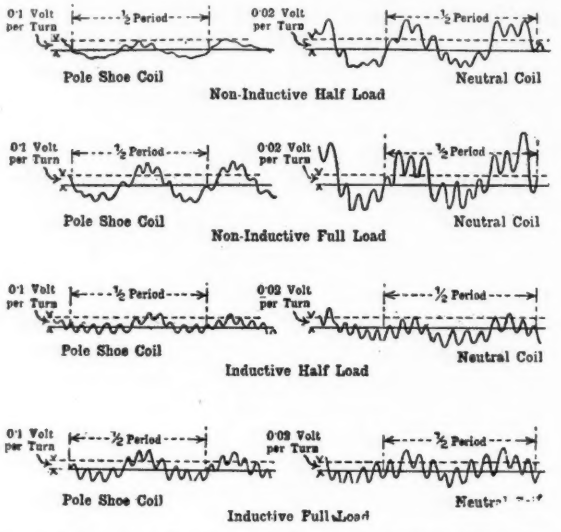


FIG. 4.—ARMATURE REACTION ON BALANCED LOADS—OPEN SLOT.

OSCILLATIONS DUE TO ARMATURE REACTION.

Under all circumstances of the experiments throughout the investigation oscillations were observed in all the search coils superposed on those due to the teeth. They are of three classes:

1. Irregular with the cycle of irregularities recurring at each revolution.
2. Regular, and three times the frequency of the machine.
3. Regular, and twice the frequency of the machine.

Those of the first class appear to be due, if not to some irregularity in construction, to the reaction of the flux produced by a local current in the armature. This current arises from a slight potential difference between the opposite points of the winding connected to the same slip-ring.

Oscillations of the second class only occurred on load, and are given in Fig. 4. They were greatest in the neutral search coil on non-inductive loads, and in the pole-shoe coil, equal on both inductive and non-inductive loads. Thus they appear to be due to armature reaction. It is generally held that the armature reaction of a balanced three-phase current is a field constant in magniture and stationary in space, but the second class of oscillations exhibited in the present investigations are quite incompatible with the idea of a constant and stationary field, and the correct explanation of three-phase armature reaction appears to be that, as the phases differ in their individual relation to the pole-piece, they differ also in the reluctance of their paths.

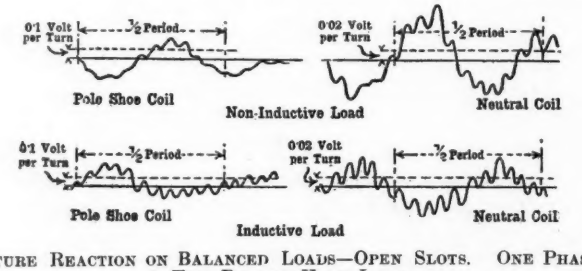


FIG. 5.—ARMATURE REACTION ON BALANCED LOADS—OPEN SLOTS. ONE PHASE, FULL LOAD. TWO PHASES, HALF LOAD.

Oscillations of the third class, shown in Fig. 5, were produced by unbalanced loads.

In order to explain the presence of the oscillations of the third class it was found convenient to consider an unbalanced load as a balanced load plus an excess current in one or two of its phases. Now it is to this excess current that the oscillations observed are probably due. They are, as has been stated, of twice the frequency of the machine, and therefore appear to arise from a complete oscillation of magnetism being produced as the phase carrying the excess current approaches toward, and recedes from, each successive pole.

PENETRATION INTO THE MAIN MAGNETIC CIRCUIT OF OSCILLATIONS DUE TO THE TEETH.

In all the coils on the main magnetic circuit oscillations were observed on open circuit and on all loads. They were least in the yoke, greater in the limb, and most of all in the pole-shoe. The oscillations are shown in Fig. 6.

It would appear that the varying degrees of penetration were partly due to the construction of the machine in the parts affected. The yoke was solid, while the limb and pole-shoe were laminated. Opposition to the oscillations would be offered in the yoke by both hysteresis and eddy currents and in the limb and pole-shoe by hysteresis alone. But although this varying degree of oscillation was observed in the different parts of the circuit, their several magnitudes were nearly constant under all conditions of load and open circuit, and when the slots were open and closed. This constancy of magnitude is the more remarkable in consideration of the variation in magnitude observed in similar oscillations on the pole-face, and in the interpolar space due to the teeth. The constancy would appear at first sight to be due to magnetic saturation of the iron, but that this was not the case was shown by the sensitiveness to change of exciting current of the main electromotive force.

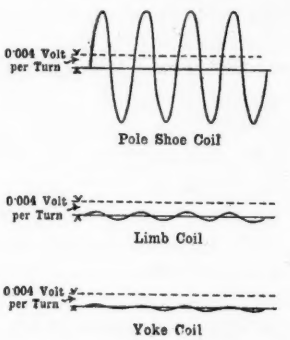


FIG. 6.—PENETRATION OF OSCILLATIONS INTO MAIN MAGNETIC CIRCUIT—CLOSED SLOTS, OPEN CIRCUIT.

In the part of the investigation now under consideration it was found necessary to guard carefully against any confusion between the cause of the oscillations

in the main magnetic circuit and the cause of those which were observed on the pole-face. For, while the latter, as has been described, were due to that local movement of the flux described as "flash" and "drag," the former were probably due to a variation of reluctance of the main mag-

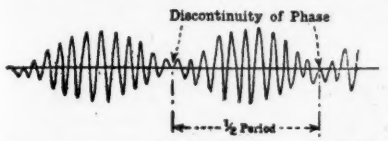


FIG. 7.—CURRENT ON RESONANCE FOR RIPPLES.

netic circuit consequent upon a variation of the number of teeth under the pole-face.

These oscillations were least with closed slots on open circuit and inductive load, and greatest with closed slots on non-inductive load. Their being least in the former circumstance is probably due to the bridge formed by the closing of the slot reducing the variations of reluctance in the main magnetic circuit, which, as has been previously remarked, govern the

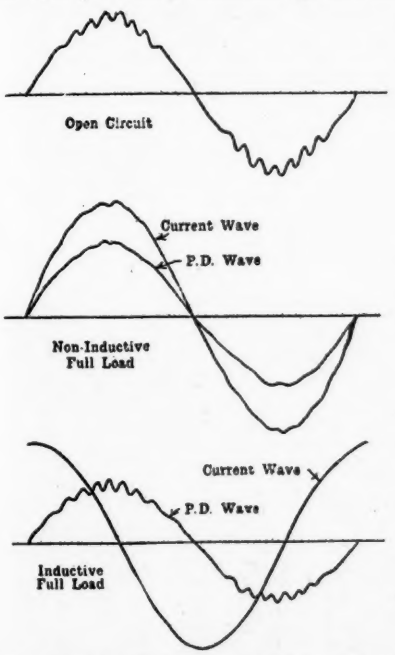


FIG. 8.—P. D. WAVES AND CURRENT WAVES ON VARIOUS LOADS—OPEN SLOTS.

magnetic oscillations under consideration. Their being greatest in the latter circumstance is probably due to the saturation of the bridge by the local flux produced by the armature current, the current in the conductors under the pole-face not being sufficient on inductive loads to produce this saturation.

INFLUENCE OF MAGNETIC OSCILLATIONS ON THE ELECTROMOTIVE FORCE WAVE.

Dr. K. Simons[1] has pointed out that when the number of teeth under cover of the pole-face is greater or less by unity than the number of slots, the ripples in the electromotive force wave exhibit a periodic discontinuity of phase.

As the machine used in the present investigation had the conditions specified by Dr. Simons, the ripples referred to were exaggerated in the current wave by means of resonance, with the result that the phenomenon reappeared. A record of this will be found in Fig. 7. It will be seen from this that the locality of the discontinuity is the neutral plane and that it occurs when the ripple is at zero value. The cause of this is that at that instant the teeth are symmetrically arranged about the pole-face. And the cause of the phenomenon itself is probably the change in the direction of field relative to the conductor and the simultaneous absence of change in the phase of the oscillations.

The ripples in the electromotive force wave, as will be seen by reference to Fig. 8, are less on non-inductive load, and equal on inductive load, to those on open circuit. This variation in ripple magnitude is due to the varying impedance offered to the ripple current by the load. With inductive load the impedance is far higher for the ripple current than for the main current on account of the high frequency of the former; whereas with non-inductive load the impedance is the same for both.

Alternators with Auxiliary Regulating Field.

A method of regulating alternators recently described by A. Heyland, and discussed briefly in the ELECTRICAL REVIEW for November 10, 1906, consists essentially in obtaining the regulating effect by modifying the alternator in such fashion that the machine produces at no load a unipolar auxiliary flux which superposes itself upon the exciter field and weakens it, the strength of this auxiliary field being more and more reduced as the armature reaction grows, becoming zero at full load. This effect is accomplished by asymmetrical air-gaps of both alternator and exciter, and by a similar unbalancing of the field windings. In the present article the inventor discusses more particularly certain questions which have arisen regarding this system of regulation. He states that the arrangement in question, if properly carried out, results in a complete regulation of the alternator voltage. Furthermore, it is possible to obtain a compounding effect, as in an ordinary compounded alternator, or to over-compound to any degree, as in an over-compounded dynamo of ordinary design. The modifications which must be made in an ordinary alternator in order to adapt it to this method of regulation may be determined by calculation with great accuracy, and there are various means of adjusting the regulation curve in the finished machine. The auxiliary flux causes no reduction in the useful flux of the alternator, the mean value for the latter remaining the same at all loads. In the arrangement preferred the auxiliary flux is produced by the difference in the magnetizing forces of the poles of opposite polarity. The most suitable arrangement from a practical point of view is that in which the auxiliary regulating flux has a maximum inductive value at no load, and it decreases with increasing load, vanishing at full load. This arrangement not only does not decrease the factor of utility, but it regulates as well for variations in speed of the prime mover as for variations in load, because the electromotive force due to the opposing flux decreases with the speed. To obtain a proper result from this method of regulation, the field under the poles in the smaller air-gap with fewer turns must, at no load, be smaller than the field under the poles having a larger air-gap and a larger number of poles; then, at full load, all the fields are exactly balanced, and the armature reaction is neutralized. In multipolar machines of large diameter a considerable portion of the flux does not pass through the exciter at all, but flows directly away from the rotating poles to the frame of the alternator. However, by contrasting the reluctance of the magnetic circuit through the exciter, the auxiliary flux which takes the path through the exciter may easily be made sufficiently large to insure proper regulation. There are various ways of increasing the reluctance of the path through the yoke; in fact, the bushings of the bearing are usually of non-magnetic material, and thus introduce a considerable gap. This matter is, however, not of much importance. The author then takes up in detail the design of an alternator of this type for 350 kilowatts, twenty-four poles, 2,000 volts, 250 revolutions.—*Abstracted from the Electrician (London), February* 8.

A merger company, probably to be known as the Indianapolis & Columbus Eastern Traction Company, is planned to combine the traction lines in southeastern Ohio and eastern Indiana. The transaction may involve a capital of $100,000,000.

[1] *Electrician*, London, vol. lviii, page 581.

Contracts Let for Hudson Companies' Tunnel Equipment.

Contracts have been let for the equipment of the tunnel system of the Hudson Companies and the work of installing portions of it is already under way in the upper set of tunnels from Hoboken, N. J., to Christopher street, Manhattan. As the tunnel construction work proper is completed the installation of rails, feeders, etc., will be carried on.

All the wiring in the new tunnels will be carried in ducts, none whatever being exposed, thus reducing the element of danger from accidents which might happen to the power-transmission system or to the trains.

Two hundred and fifty cars have been ordered for the requirements of the train service. These cars will embody several radical departures from present-day standards of construction. They will be constructed entirely of metal, no wood being used whatever, and the cushions of the seats will be of fireproof material. The cars will all be of the motor type and will seat fifty persons comfortably. The trains will consist of eight cars and will be run on one and one-half minutes' headway. It is expected that the running time from Cortlandt street, Manhattan, to the Pennsylvania station in Jersey City will be three minutes, and to Newark fifteen minutes.

A feature which will tend to guard against accidents will be the centering of control of the entire train in the motorman, even to the opening and closing of the train doors. There will be side and end doors on each car operated by compressed air and controlled by a lever in the motorman's cab. These doors will be opened and closed on signal and the pressure is so minutely balanced that it will be possible to stay the motion of a door by one hand. There will be no straps in the cars, which will be floored with cement set with carborundum to prevent slipping and permit thorough cleaning.

To furnish power for the operation of the train service throughout the entire system and also for the immense terminal at Cortlandt street, a power-house 230 feet by 200 feet is being built in Jersey City. This structure will accommodate a generating plant with a capacity of 32,400 horse-power and will be constructed of brick and metal, no inflammable materials being used. The boilers will be sixteen in number and will be the largest in size in the country. They will be fed by machinery automatically operated from coal bunkers in the top of the building having a capacity of 5,000 tons.

Illumination of the Boston Herald Building.

The proper illumination of the plant is one of the important factors of success of a modern newspaper, especially as much of the work must be performed under artificial light. The recently completed installation of the Boston Herald Company is an excellent example of modern practice in such artificial illumination. The lighting of the large rooms of this plant is accomplished by the use of arc lamps, the installation having been planned by the illuminating engineering department of the General Electric Company in collaboration with the manager and engineer of the Herald company.

Newspaper work presents four general classes of illumination: first, business offices; second, reportorial and mailing rooms; third, type-setting and linotype department; fourth, press room.

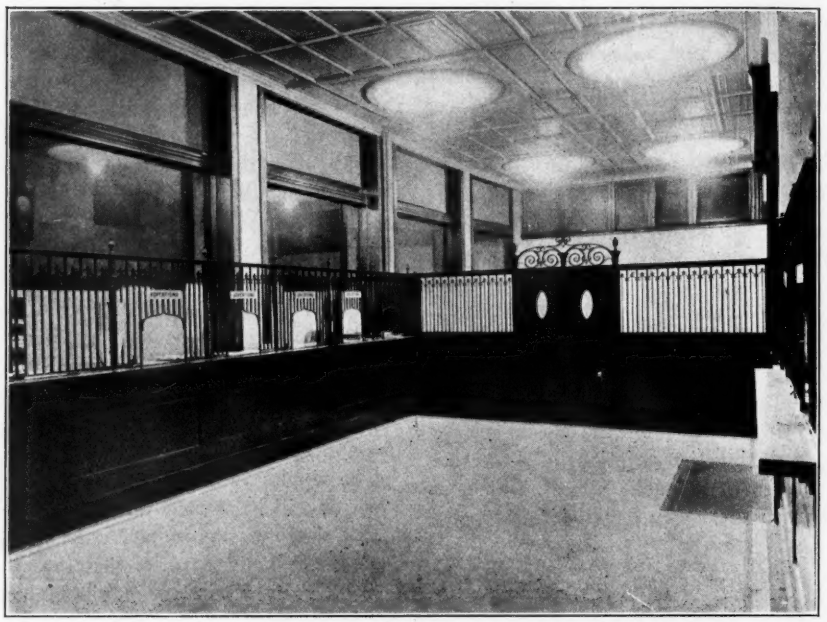


FIG. 1.—OFFICE, BOSTON HERALD.

The business office demands an ornamental installation capable of producing a strong illumination free from dense shadows. In the case under consideration, this was obtained by the use of the high-current enclosed arc lamp with the re-

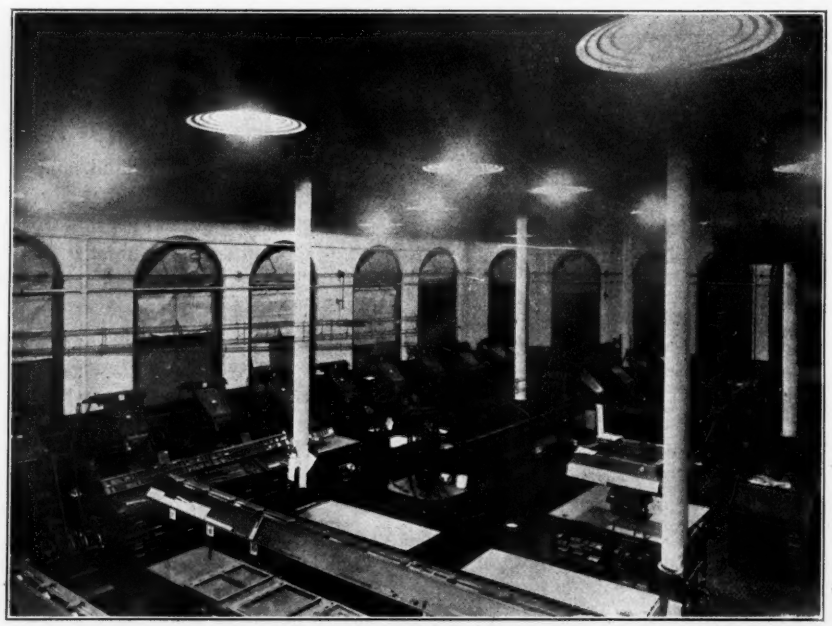


FIG. 2.—COMPOSING ROOM, BOSTON HERALD.

cessed type of light balancing selective diffuser ceiling. The appearance of the office at night as illuminated by this system is shown in the accompanying photograph, Fig. 1, which was taken without the use of any extraneous light. The lamps consume six and one-half amperes each at 110 volts (nominal) direct-current line. The room is flooded with a soft even light so that there is no difficulty in reading in any part. As the light sources are large and of a low intrinsic brilliancy, no uncomfortable blinding effect is experienced, even when looking directly at the lamps.

In the reportorial rooms news is received, classified and put in readable form. It is a large open office, well filled with desks. All the desks must be illuminated so as to facilitate rapid work without eye-strain. In the mailing room, newspapers are received from the press rooms, counted and marked for distribution. These rooms have about eleven-foot studding and are lighted by five-ampere direct-current multiple enclosed arc lamps with concentric light diffusers. The lamps are hung as high as possible.

Type-setting and linotypes require especially good light in order to permit the operators to read type rapidly. The metal faces have dark dead surfaces without any color contrast, and the type is reversed, making it quite difficult to read, even under the best conditions. The illumination has been accomplished by the use of a large number of five-ampere enclosed arc lamps. Owing to the height of studding, inverted diffusers are used. With this combination it is possible to hang the lamps quite high, concentrating the light downward, producing a strong even illumination, free from glare. The accompanying night photograph, Fig. 2, shows the arrangement of the room and the effective illumination produced.

Perhaps the most difficult department in which to obtain a satisfactory general illumination is the press room. While the general illumination is not required to be as strong as in the type-setting department, the presses extend up within about three feet of the ceiling and the room is so filled up with overhanging platforms, rolls and other machinery, that it is very difficult to avoid dense shadows. By the use of the enclosed arc and the inverted diffuser, very good results have been obtained. The light has been projected into the machinery, so that the use of small incandescent lamps has practically been dispensed with. The illumination of this room is illustrated by the accompanying night photograph, Fig. 3.

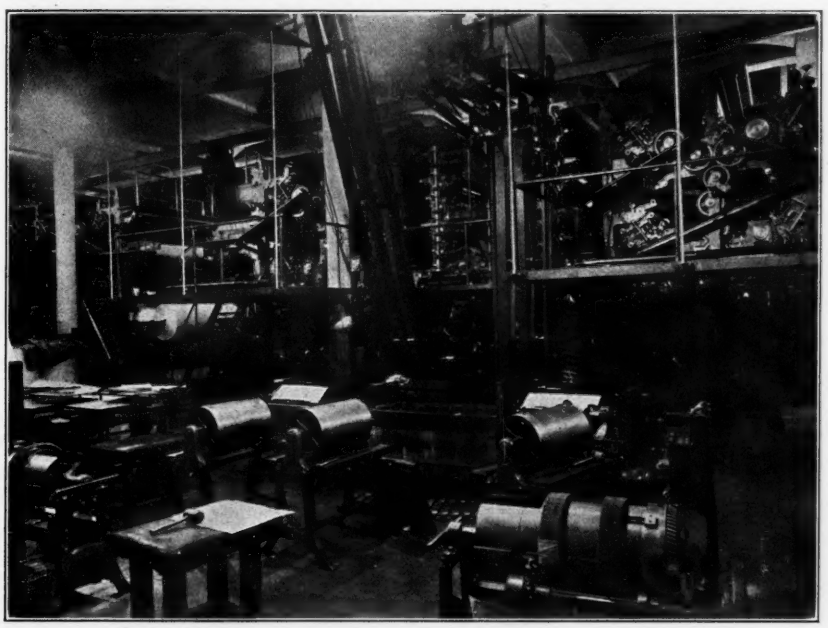


FIG. 3.—PRESS ROOM, BOSTON HERALD.

Some seventy-five enclosed arc lamps are required to illuminate the various departments of the *Herald* plant. These, with incandescent lamps in the smaller offices, halls, etc., make the *Boston Herald* plant one of the best lighted in the United States.

University Appropriation Bills.

Three appropriation bills for the University of Illinois, Urbana, Ill., have been introduced in the Illinois senate by Henry M. Dunlap. One calling for $1,000,000 for new buildings and additions to those now overcrowded and inadequate, one for $386,000 to house the College of Medicine, another calling for $1,664,000, chiefly for running expenses and general cost of maintenance.

Toronto Electric Light Company's Report.

The Toronto (Canada) Electric Light Company's report for the year ended December 31, 1906, as presented at the annual meeting of the shareholders, showed income of $899,578.56, with expenses (including interest on debentures) of $336,730.92, or a little over 11.2 per cent on the paid-in capital of $2,997,900. After paying three quarterly dividends at the rate of seven per cent per annum and one at the rate of eight per cent, amounting to $277,271, a balance of $119,459 was carried forward to profit and loss, bringing the total up to about $218,057. Of that amount $200,000 was transferred to reserve account, which totals now $500,000.

Mention was made of the proposed $1,000,000 increase in capital stock to provide for extension of plant.

During the past year 62,352 lamps were installed and 2,020 horse-power of motors. With the introduction of Niagara power it is expected the increase this year will be materially greater.

In moving the adoption of the report the president forecasted a probable reduction in prices of light and power as soon as the new plant is working smoothly.

In the statement of assets the company's plant, including real estate, is valued at $3,241,950, and the Incandescent Light Company's plant at $989,350.

The Mechanical Equipment of the Remodeled Tribune Building, New York City.

The New York Tribune Building, located at the corner of Nassau and Spruce streets, New York city, has been remodeled and doubled in height, necessitating an enlarging of the mechanical equipment. The new engine equipment required for power and electric service consists of three duplex compound engines aggregating 650 horse-power. These engines were furnished by the American Engine Company, of Bound Brook, N. J. Two of them drive direct-connected electric generators. The third engine is used to drive the presses upon which the *Tribune* is printed.

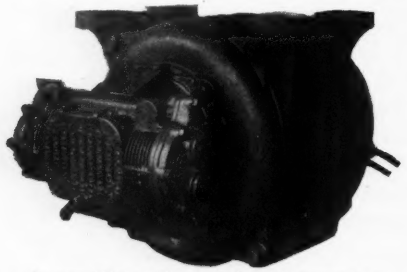
For ordinary lighting incandescent lamps are used, and Cooper Hewitt mercury vapor lamps are also used extensively throughout the various departments.

The steam plant consists of four Babcock & Wilcox high-pressure boilers. The building is heated by direct radiation, containing over 35,000 square feet of radiating surface divided into about 1,000 heating units.

THE EXPERIMENTAL MOTOR-CAR OF THE CITY & SUBURB RAILWAY, BLANKENESE-OHLSDORF, GERMANY.

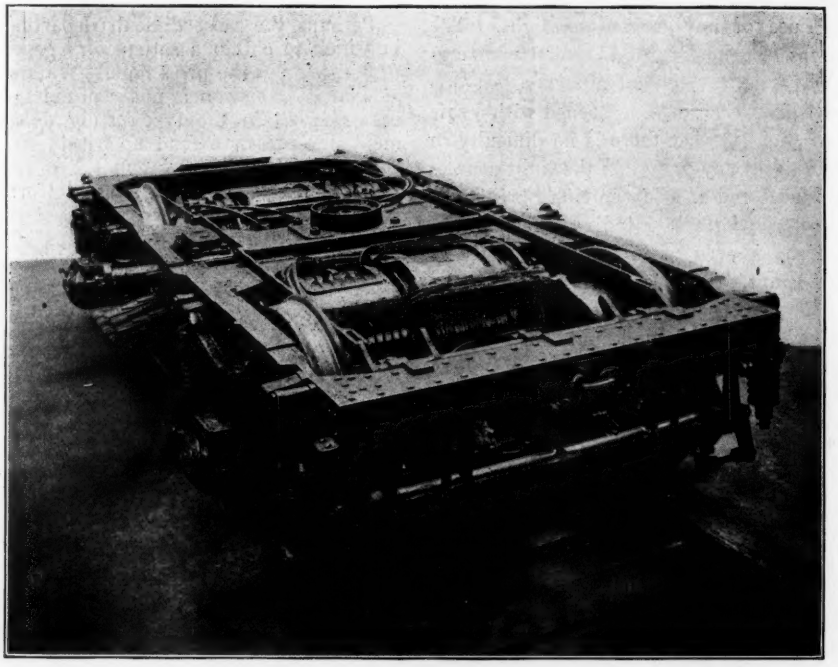
BY FRANZ KOESTER.

A comparatively prominent electric railway recently opened to the public is that of Blankenese-Ohlsdorf, near Hamburg. It is a road of about sixteen miles in length for city and interurban service. The original plans in 1902 called for a direct-current system, but on account of the later rapid development of the alternating-current, single-phase system it was decided to require additional bids on this improved system, and in 1904 it was determined to install a system similar to that on the Spindlersfelder road, and fifty-one motor-cars were therefore ordered. It was further decided to build a power plant. In order to assure a satisfactory operation of the system immediately on its opening, a sample car was finished at once according to the new designs, for experimental service on the above-mentioned Spindlersfelder road.

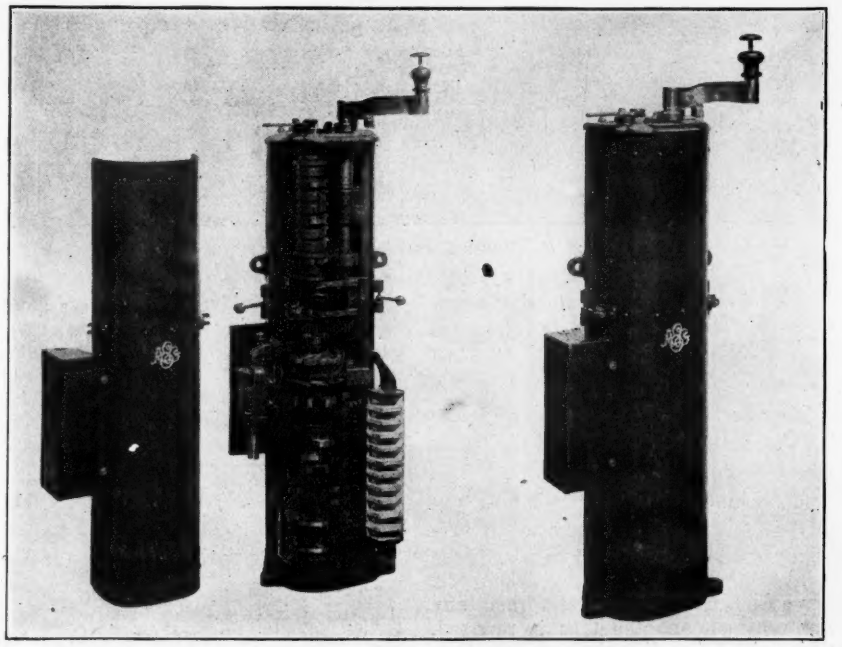


THREE HORSE-POWER AIR-COMPRESSOR, BLANKENESE-OHLSDORF RAILWAY.

One of the accompanying illustrations shows the six-axle car, consisting of two separate halves, each having two trucks, one with two axles and the other with one. It has been modeled after the cars of the Berlin City & Suburban Railway. There are no trailers; therefore, in case greater capacity than one double unit is required it is necessary to add another complete unit. One half of this double car is provided with two sliding bow trolleys and the two axles of the truck of this car are each equipped with a motor. The car is divided into seven compartments, two second and five third-class. Directly in back of the motorman's compartment is the third-class section, with removable seats, so that it may be used for post, freight, etc. The other part of the car is arranged practically the same as the cars on the Prussian Railway, with a door at each end of each compartment. The second half of the double car is divided into four third-class and three second-class in the reverse order, thus placing the second-class passengers together in the centre of the unit. The extra third-class compartment in this half is used by the motorman when the direction of travel is reversed. The first part of the car has a high and a low-tension compartment, and the second part has only a low-tension compartment to supply current to the motor on the last axle. Although, as shown in the illustration, the cars are coupled very close together, there is no connecting passage between them. The roof of the car is made of wood, covered with heavy canvas, on top of which are placed interconnected strips of leaded iron which also connect to the ends and sides of the car. The sides are sheathed with iron, thus giving a short-circuit path for the current in case the high-tension feeders are dropped.



TRUCK AND MOTORS, BLANKENESE-OHLSDORF RAILWAY.



TYPE OF MASTER CONTROLLER USED ON BLANKENESE-OHLSDORF RAILWAY.

The cars are equipped with Karorr air-brakes, working upon the four wheels of each truck. Each truck is provided with a brake cylinder and an auxiliary air re-

ceiver, while on each car there is one main air tank. An air-compressor is mounted on the truck, as shown herewith, representing the rear truck with the low-tension motor on the second car half. The entire over-all length of one of these double-car units is ninety-seven feet, and the width is 8.5 feet, with a weight of 71.14 long tons.

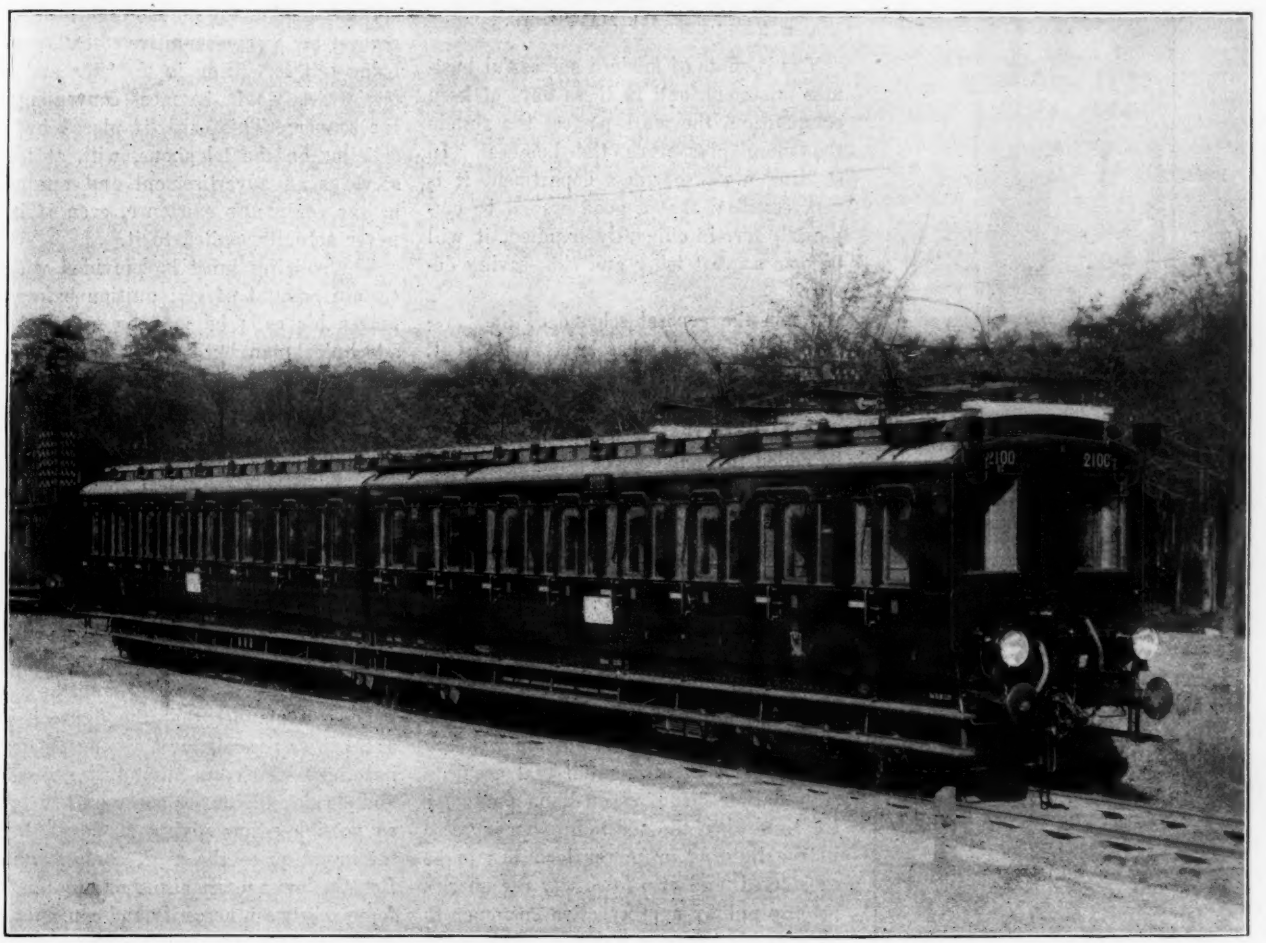
The line is supplied with current at an average potential of 6,000 volts, twenty-five cycles, single-phase, the regulation being such that the potential never falls below 5,200, nor rises above 6,800. The wires are supported by catenary suspension about seventeen feet high in the open, and 15.5 feet under bridges, zigzagging through the entire length, thus reducing the wear on the collector to a minimum. The rail acts as return.

The operation of the double car is accomplished by means of three Winter-Eichberg single-phase, 750-volt motors. These motors are of the same design as those for the Niederschoeneweide-Spindlersfeld, with the exceptions that they are more strongly built and are provided with a ventilating arrangement. This latter is accomplished by drawing air in through a hollow shaft and discharging it through the armature in such a way that it does not affect the commutator or the brushes. Oil is fed to all the bearings under pressure. The motor is of the four-pole type, with the brushes placed ninety degrees apart. There are six brush-holder arms, four for short circuit and two for the exciter. The motor is coupled to the axle by means of spur gears in the ratio of 1 to 4.22. At 600 revolutions per minute these motors will develop 115 horse-power each. The maximum speed is fifty kilometers (about thirty miles), at which speed the motors run at 1,120 revolutions per minute. These motors are hinged on one side to the train axle and on the other side to springs on the truck frame and are capable of even higher speed than that noted above.

The car is equipped with an oil insulated transformer supported below the car body. This transformer lowers the line current from 6,000 to 750 and 450 volts. Each half of the car is equipped with an exciter transformer, one for the two motors and one for the third motor. All current for exciter, controlling, lighting, heating and operating the air-pumps is taken at 300 volts.

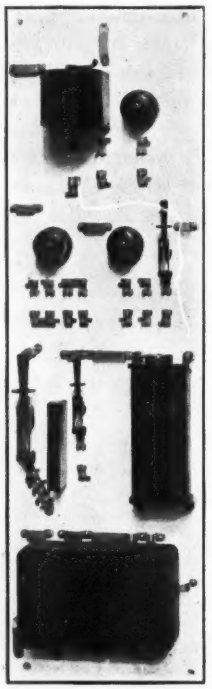
The equipment is protected by a Horn lightning arrester, with carbon rheostats. The entire high-tension layout is on one half of the double-car unit, and does not have to be connected to the second half. The control of the motors is purely electrical on the Allgemeine Elektricitats Gesellschaft's system, and it is easily possible to control any number of motors from the one controller on the first car of a train.

In the car barns a line voltage of 300 is used and provision is made for lowering the high-tension trolley bows and raising the low-tension pole on entering the barn, at the same time changing the connections. The double cars are connected together by three couplings, one being held in reserve. The electric coupling is made up of a cable of twelve very fine wires, and is used for low tension only. The cars, as previously stated, are lighted from a 300-volt circuit, and are equipped with forty-eight-volt lamps, there being four sixteen and two twenty-five candle-power



DOUBLE CAR UNIT, BLANKENESE-OHLSDORF RAILWAY.

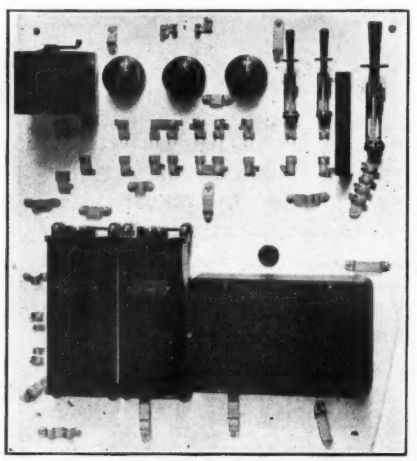
lamps on a circuit. Each compartment has two lamps, supplied from different circuits, so that the total illumination is never liable to be interrupted. Each end of the car is equipped with headlights



LOW-TENSION SWITCHBOARD IN THE SINGLE-MOTOR CAR SECTION.

and signal lamps. The cars are electrically heated by a number of rheostats of from one to two kilowatts each.

As already stated, the air-compressor is mounted on the truck and will be seen



LOW-TENSION SWITCHBOARD IN THE DOUBLE-MOTOR CAR SECTION.

in the illustration herewith. As will be seen it is double-acting and is operated from a three-horse-power, 300-volt motor. An automatic air-pressure regulator is arranged to start the motor when the pressure falls below seven atmospheres and to cut the motor out when the pressure rises to eight atmospheres. All main switches, trolley contacts, etc., are operated by air pressure. All other details of the equipment are in strict accordance with the best modern practice. The cars are being designed and built by the Allgemeine Elektricitats Gesellschaft, of Berlin.

ORGANIZATION AND CONDUCT OF A NEW-BUSINESS DEPARTMENT SUITABLE FOR CENTRAL STATIONS IN CITIES OF 50,000 POPULATION AND UNDER.[1]

BY R. BORLASE MATTHEWS.

The keynote of modern successful business is system, and in these days of keen competition, the more perfect the system the more prosperous the business. In starting a new-business department it is very essential that a good system be employed, for, intelligently handled, it will become a great labor and time-saving device.

When the general scheme of the "system" to be adopted has been worked out, a general instruction book should be prepared. Such a book should be of the loose-leaf form so that fresh instructions can be added in their correct place from time to time, as the system develops in its details.

Too much stress must not be laid on the "system," for after all it is but a means to an end; alone it is of very little avail, it must be backed up by sound common sense and good management.

The first thing that should be done in the actual work of the department is the compilation of a card index of existing customers, as it is essential that accurate information should be on hand ready for the time when the question of an increase in the lighting or power load has to be considered, and also to satisfy the queries usually put by a prospective customer as to what his neighbor is doing. This index should be arranged in alphabetical order of the streets of the city in which the building is located, and not according to the initial letter of the customer's name or the number that has been allotted to him, since from the point of view of the supply of current the building is the permanent feature and the occupant merely temporary. On the same card should be placed the customer's rotation number, and a note as to his connection in equivalent sixteen-candle-power lamps and in horse-power of motors installed.

The cards should be distinctly marked by a rubber stamp, say with a broad red band across the centre, so that they may be readily noted when placed with cards containing names of those who are not customers.

The most likely field should first of all be attacked, the stores on the main streets and the factories, then the smaller stores and larger residences should receive attention, and so on until the whole town is canvassed. The solicitor when making a call should not omit "to leave his card." The card suggested as advisable would be a postal card, addressed to the central station, and having on the back a printed request for a representative to call, spaces being left for filling in the time and the day which would be most convenient to the sender. This card, if placed by the solicitor on the telephone, will, at least, serve as an advertisement and reminder of the company's existence, even if it is never actually mailed to it.

The solicitor must be provided with a certain amount of ammunition before he makes his call; he may or may not be a technical man, but he must be thoroughly coached and posted in those matters which he has to deal with, for it is fatal if the prospective customers realize that they are talking to some one who does not know much more about electrical business than they do. In residence canvassing it is well to endeavor to at least arrange to be allowed to present an estimate on wiring the house. The estimate should be prepared in two ways—one with the wiring done in the way that best suits the convenience of the householder, and the other in such a manner that the figure is cut as much as possible, by omitting all lights but those which are absolutely necessary, and also leaving out as many wall switches as possible—thus giving an idea of the minimum price the work could be done for; the lower figure also shows up the difference between necessity and convenience, and puts in a somewhat better light what at first appears to the average householder to be a very high figure. Chandeliers and other fixtures should always be figured upon as extras, as taste varies so much in the selection of these fittings, and their price added to the cost of wiring makes the latter appear excessive.

A standard form should be prepared for use in getting the wiring data together, to ensure that nothing is omitted, and also so as to see that if the work is bid upon by more than one contractor, they base their estimate on the same specification.

As a rule it will be found best that the solicitor should not make an estimate at the time of the calling, though it is well

[1] One of the papers presented in the competition held by the Cooperative Electrical Development Association, Cleveland, Ohio.

that he should be able at times to give an approximate figure, making it quite clear to the prospective customer that this is so, and at the same time making mention that an accurate figure will be presented in the course of a few days' time.

If the solicitor has with him illustrations of some of the principal components employed in house wiring, it will aid much in his explanations of such things as the difference between side brackets and drop lights, between flush and wall switches, etc.

Power soliciting is much more difficult than the canvassing in residences and stores. It requires, if it is to be handled successfully, the services of a trained technical man.

The best method of dealing with the power situation is to investigate the conditions in each factory by turn, making tests where possible. The owners are usually quite willing to grant permission for this. Some factory is certain to be reaching the point of overload of its own power plant; this affords the opportunity for the central station.

The installation of a motor, say on a sixty-day trial, is almost invariably a safe risk to undertake. Under these conditions the best method of installation must be insisted upon and every care expended to insure the most economical results, by taking every advantage of the flexibility of a motor drive, and the possibility of cutting out all unnecessary line shafting, for the greater the economy effected, the sooner is the owner convinced of the good value of central station power.

Circulars and pamphlets, bearing on the use of central station power in factories, keep the manufacturer's interest alive. Illustrations of various applications of motors, though not dealing with the particular business the manufacturer may be interested in, will cause him to think of some machine in his own business to which a motor could be applied in a somewhat similar way. As the number of booklets required is small, the cost of producing special advertising publications for power users is proportionately greater than in the larger field of residence and store lighting, so advantage should be taken of the pamphlets and flyers issued by the manufacturers of motors, who are usually glad to forward copies of the same for distribution.

The special folders and booklets prepared by the various advertising specialists are also very useful.

Personal solicitation as here illustrated is much, but it is not all; it needs to be allied with that powerful assistant, newspaper and direct-by-mail advertising. A persistent course of advertising is most important, and not merely the ordinary style, but also that which is educational in its nature, bringing forcibly to the front the many advantages and economies of electric light and power. For it is wonderful how ignorant the residents of the average city still are concerning electricity and its applications. They hardly know whether a store is lighted by electricity or not, though they appreciate the fact that one store is better lit than another, or notice that they can match colors more correctly in some stores than in others, but, unfortunately for the central station manager, they do not often realize that the light they find most efficacious is due to electricity. Therefore, it becomes his aim to enlighten them, figuratively speaking as well as literally.

Local newspaper advertising is of great value and should be regularly employed. The matter should be direct and to the point, giving convincing reasons for statements, not merely making unproved assertions. There must be something about it different from other advertisements in the same paper, so as to attract attention, and having attracted attention there should be something worth reading. No advertisement should appear without the full name and address of the office of the central station, not omitting the telephone number.

The manager must be careful to observe any points in the local papers which may be useful to him in his business. Announcements of the erection of new houses, the alteration or extension of present buildings, the prospective opening of new stores—all these will present possibilities of new business and must not be overlooked. It will also be found a good plan to clip from the local newspapers any items dealing with electrical matters in general, and the local electric supply service in particular. These cuttings entered into a scrap book will be useful for reference, as it is desirable to keep track of the amount of notice that is being given in the local press during different periods.

One of the most important and live advertisements a central station can have is a store (part of which may be used as an office) on the main business thoroughfare, and on the right side of the street. Every one comes down the main street at more or less frequent intervals, and the store window will become to the passers-by a silent yet speaking reminder of the existence of the electric light company, and also an important educational factor.

One or more meters should be installed so connected as to demonstrate to a customer how such instruments register directly in proportion to the load upon them, and also to explain how they are read.

It is essential to hang out an electric sign in front of the store, a sign that can be seen at night some distance up and down the street. On no account should a cheap, poorly lighted sign be employed; yet, on the other hand, too elaborate a scheme should be avoided. It must give ample light so as to be an example worthy of emulation by the business men on the street, acting as an incentive to them to increase their lighting and to get signs for their own use. In any case it does not do to advocate a system of advertising which at the same time is apparently not considered worth adopting for the benefit of the central station itself.

The so-called "free sign," really "rented sign," system should be carefully looked into, as it possesses many valuable features, and is an excellent means for increasing profits. In this connection also should be considered the merits of the controlled flat rate, that is, a flat rate based on the turning on and off of lights at a stipulated time by the light company's patrolman.

Mention has been made of the comparatively recently introduced method sometimes known as "direct-by-mail" advertising. This consists in the systematic mailing, at regular intervals, of a series of personal circular letters, folders, booklets and mailing cards. It is a very successful scheme, and on account of its recurring regularity keeps the service of the central station continually before those to whom they are sent. Matter for a purpose of this kind must be attractive enough to stand out amongst the pile of advertising received in the daily mail and interesting enough in appearance to cause the receiver to glance at it long enough to appreciate the fact that the central station wants his custom.

To take advantage of this system, the assistance of the advertising concerns must be sought, for the cost of the preparation is beyond the reach of the average central station owing to the small quantities required, whereas the advertising companies by syndicating the matter are able to supply the same at low prices.

For the proper and economical distribution of direct-by-mail advertising, a carefully prepared mailing list must be used. Undoubtedly, the best way of doing this is to employ one of the several addressing machines on the market, the best types being those in which the addresses are on

separate holders, as they can easily be corrected and serve as an index in themselves when put away in the cases. The face of the letters should preferably be in imitation of typewriting, as it impresses the recipient better than stencil. The addresses should be prepared from the main card index mentioned at the commencement of this paper, but divided up into three main sections (S) stores and business places, (R) residences, (P) power users. In the case of present customers their rotation number should appear on the address, together with a distinguishing letter, say S, R and P respectively, to indicate which section they belong to, should the address holders by any chance get out of place. As is suggested for the main card index, each of these sections should be arranged in alphabetical order of the streets. It may at first seem somewhat an expensive recommendation, the adoption of a machine of this kind, but it is a labor-saving device, and it must be remembered that a customer's name has to be written out at least three times a month, namely, on the bill, the voucher and the envelope, and as regards the other addresses, they are first wanted for the advertising matter, and then owing to the inauguration of the new-business department, it will not be long before a very large percentage of them will be converted from prospective to actual customers.

Some of the advertising concerns offer to take charge of the mailing, but it is usually preferable to mail locally so as to get the postmark of the home town on the wrapper, for attention is not then unnecessarily drawn to the fact that the work is done by outsiders. Circular letters and form letters should be mailed with a two-cent stamp and printed in imitation typewriting.

As the newspaper and mail-advertising campaign is bringing in inquiries before the solicitors have completed their preliminary systematic canvass of the territory, arrangements must be made for taking prompt and proper care of them. The solicitor in whose territory the enquiry emanates being advised to look it up as promptly as possible.

The solicitor in making out the report of each call, should indicate whether the occupant was (1) not at present interested, (2) partially interested in (L) light, (H) heat, (P) power. The object of this being to possess a record which shall form a guide as to the advertising literature that should be sent to arouse interest or to bring past the stage of partial interest. A card index which is a duplicate of the address plates of the addressing machines should be prepared and arranged in the same way, so that the three main sections, *i. e.*, the S list (stores and business places), the R list (residences), and the P list (places where power is used), will now each have been divided into six subsections, indicated as below:

Mark.			Indicates that the Addressee
S—List.	R—List.	P—List.	
S (1)	R (1)	P (1)	Is not at present interested.
S (2)	R (2)	P (2)	Is partially interested in light, heat and power.
S (2L)	R (2L)	P (2L)	Is partially interested in light.
S (2H)	R (2H)	P (2H)	Is partially interested in heat.
S (2P)	R (2P)	P (2P)	Is partially interested in power.
S	R	P	Is a customer.

Every day a council of war should be held, the manager and his assistants meeting to talk the general situation over. In this way notes can be prepared, and in the case of certain as yet undecided prospects, very often some one of the staff may know of some local or friendly influence that might be of considerable assistance in obtaining the required decision.

As the new-business department advances, it will be found necessary to get more solicitors into the field, so that more frequent calls may be made and no prospective customer neglected in any way.

The question arises as to where the new solicitor should be obtained, the terms of payment he should receive and whether he should be a local man or a stranger. With an outsider, it will necessarily be a couple of months before he acquires the necessary local knowledge, but on the other hand he is probably accustomed to the work, having been selected on that account. As a stranger, he will often interest people and get new business that the local man can not. Yet the local man has also many advantages in his favor, so that if he has the qualities required for a successful salesman, and has sufficient knowledge to enable him to offer suggestions and answer the technical questions that are sure to arise, he will be able to do good work. Evidently, therefore, part of the staff should be outsiders and the others local men.

A solicitor usually receives a salary of sixty to seventy-five dollars per month, which is assumed to be sufficient to cover his living expenses, and then a commission is paid on all new business secured.

This commission may be a flat amount per customer secured, or, better still, a graded rate depending on the value to the company of the new business secured.

It is not advisable to give a percentage on sales of apparatus, as it might often be a temptation to the solicitor to sell things that are not to the best advantage of the customer.

A modified commission scale should be open to employés other than the solicitors, to encourage them in persuading their acquaintances to become customers. At the same time it should be clearly pointed out that when some one is interested in this way, assistance should be sought to close the deal.

As an encouragement to employés to put forth their best efforts, a list of new customers should be posted up each month in the office, together with the name of the man who obtained the new business, recognition of this sort generally being much appreciated.

Another commission scale should be prepared for wiring contractors, with the commission payable preferably one month after the installation has been in use.

A reduction of rates will not increase business as much as systematic canvassing does, provided that the existing rates are not excessive. The reason that many people do not wire their houses is chiefly on account of the fear they have that the cost of so doing will be out of proportion to the advantages derived, hence the importance of dispelling any illusions that they may have on this point as soon as possible. The majority do not even ask what the rate is, though they often want an estimate of the probable monthly bill. They do not understand the rates as a rule, and knowing that the prices are the same to everyone, are satisfied that if their neighbors use it the charge must be all right, so that to them it is all a question of installation cost.

An information file should be kept in the office, for the general reference of the staff, containing illustrations, data and prices of special combined apparatus designed for operation with the electric current, such as coffee grinders, milk shakers, air-pumps for raising liquids, heating devices, etc. Such a file is very useful in assisting customers in the selection of labor-saving and, incidentally, current-consuming devices, therefore a special effort should be made to keep it well abreast of the times. It should be classified according to the uses to which the apparatus can be put, basing the classifi-

cations on some well-known standard system such as an extension of Dewey's, which is employed by nearly every public library in the country. A card index should also be prepared for use in conjunction with the file collection.

The next point to be considered will be the question of the total expenditure needed for the maintenance of an aggressive new-business department. It may be mentioned as a guide in this matter that some of those central stations that have proved such a department to be a success are laying aside from two to three per cent of their gross income for its maintenance; their gross income being at present in the neighborhood of five dollars per capita per annum. About two-thirds of this amount is apportioned to personal solicitation and the balance to general advertising expenses.

The great battle that advertising methods have had to fight in the past has been that it was so difficult to directly ascribe the result in increased business as due to this form of publicity; now, however, it is a recognized fact, and the path of the advocate of advertising is a great deal easier. In starting a new-business department, it takes a little time before the results begin to show, but if the department is run on modern lines they must appear sooner or later. Now, from the business man's point of view it is desirable to know how much these results cost, so it is essential to prepare a monthly report, based on the solicitor's daily reports, giving statistical details as to the number of customers secured, their connected load, and probable average load; increased connections of existing customers; business discontinued; comparison with results obtained in the same month a year ago; the number of personal interviews; the number of form letters, and other printed matter sent out; the total cost, etc.

The Railway Signal Association.

The next meeting of the Railway Signal Association will be held at the Great Northern Hotel, Chicago, Ill., March 18. The programme has been announced as follows: 10 A. M. to 12 M., discussion on general specifications for electric interlocking; 12 M. to 1 P. M., discussion on installation and maintenance of storage batteries; 2.30 to 3.30 P. M., discussion on signal lamps; 3.30 to 4.30 P. M., discussion of special committee report on interlocking and block signals.

The Faraday Society.

The twenty-sixth ordinary meeting of the Faraday Society was held on Tuesday, January 29, 1907, at the Institution of Electrical Engineers, 92 Victoria street, S. W., London, England, when a general discussion on osmotic pressure took place. Professor H. E. Armstrong, F.R.S., was in the chair.

The discussion was opened by the Earl of Berkeley, who exhibited and described his apparatus for the direct measurement of osmotic pressure.

The ordinary direct method of measuring osmotic pressures is to obtain equilibrium on the two sides of the semi-permeable membrane by means of the pressure of a head of liquid. The method devised by the author and E. G. J. Hartley substitutes mechanical pressure, which is put straight on to the solution, and equilibrium thus obtained. Reversing the usual arrangement, the solution is put outside the semi-permeable tube, in an outer containing tube of gun-metal, and the solvent inside, suitable mechanical arrangements being provided for rendering the joints leak-tight. The pressure is obtained from a plunger worked with a pile of weights and delivered through a mercury U-tube to the solution outside the septum. Equilibrium is obtained or calculated by watching through a telescope the motion of the solution in a gauge. The measurements may be made at any desired temperature. Corrections are applied for the imperfect semi-permeability of the membrane by analyzing the solvent to see if any solution has passed into it.

A vapor-pressure method for measuring osmotic pressure was also described. This is a modification of the Ostwald and Walker dynamical method. Air is sucked through a spiral train of glass vessels containing first sulphuric acid, to dry it, then the solution from which it gets saturated up to the vapor pressure of the latter, then the solvent, of which it here takes up more, and finally sulphuric acid again. There are two trains of vessels arranged to oscillate about a central axis, so that the air does not actually bubble through the liquids, which is unsatisfactory, but merely passes over them, glass beads being placed in the tubes to increase the melting surfaces. The whole apparatus can be placed in a bath and worked at any desired temperature. Arrhennius's relation was used for calculating the osmotic pressures from the lowered vapor pressures, and very concordant results were shown to have been obtained between measurements made by the direct-pressure and the vapor-pressure methods. The author is of the opinion that the latter method will chiefly have to be relied upon to furnish accurate data for the further study of osmotics.

W. C. Dampier Whetham, F.R.S., speaking on "Indirect Methods of Measuring Osmotic Pressure," agreed as to the importance of the vapor-pressure method. He discussed the formula used by Berkeley and Hartley, and explained the difference between it and the van't Hoff formula obtained from thermodynamic considerations, the expressions being identical where there is no change of volume of the solvent as it enters the solution.

Dr. T. M. Lowry spoke on "Osmotic Pressure from the Standpoint of the Kinetic Theory." The motion of the particles postulated by the kinetic theory leads in the case of composite gases or liquids to a process of diffusion. When diffusion is resisted a pressure is set up which constitutes the osmotic pressure of the system. This can be effected by means of a semi-permeable membrane, through which only one of the constituents can pass. Such membranes undoubtedly act in virtue of their solvent properties.

The application of the equation $PV = RT$ to the osmotic pressure of gases could be predicted on general theoretical grounds, but there was no *a priori* reason for supposing that it would be applicable to the case of liquids. The mere fact that all liquids were not miscible was sufficient to show that the conditions were widely different from those prevailing in mixed gases. The validity of the law had been established experimentally, and must be accepted as a fact of fundamental importance in all discussions as to the nature of osmotic pressure.

In the early years of the osmotic discussion it had been assumed by van't Hoff and others that since osmotic pressures and gas pressures could be calculated by means of the same formula the conditions must be identical in the two cases, and it was definitely stated that in dilute sugar solutions the osmotic pressure was wholly due to the bombardment of the membrane by the molecules of the sugar, the effects produced by the water molecules being substantially identical on either side of the membrane. The alternative view, that osmotic pressure represented a diminution in the activity or "active mass" of the solvent was suggested by Poynting in 1896, and had subsequently been advocated by Armstrong, Beilby, van Laar, and others. In most cases it had been as-

sumed that the essential factor was a diminution in the average energy of the water molecules. From the standpoint of the kinetic theory this was unnecessary, as also was the view advocated by Rodger and by Traube that the solute was directly combined with one or more molecules of the solvent. The mere presence in the surface of the solution of molecules of the solute which could not enter the membrane was sufficient to check the escape of solvent particles from the solution into the membrane, without affecting the reverse passage of solvent from the membrane into the solution. This would lead to a diminished solubility on the side of the solution and to a flow of liquid through the membrane which could only be checked by putting pressure on the solution.

The simplest case of a semi-permeable membrane is undoubtedly to be found in the surface of separation between liquid and vapor. At such a surface the kinetic theory postulates a continual interchange of molecules between the two phases. But while the rate of escape or evaporation would be reduced by the presence of non-volatile molecules in the surface, the rate of condensation would be unaffected, and equilibrium could only be restored by decreasing the vapor pressure and so diminishing the rate of condensation at the surface of the solution. In this case a quantitative relationship could be deduced. If N and n were the relative numbers of particles of solvent and solute in the surface and p and p^1 the vapor pressures of solvent and solution, then if each molecule of solute replaced a single molecule of solvent in the surface layer, the reduction of vapor pressure would be shown by the equation $\frac{p^1}{p} = \frac{N}{N + n.}$ It had been shown by Nernst that from this simple relationship the identity of the osmotic pressure of a dilute solution with the pressure exerted by a gas of equal molecular concentration could be directly deduced. The blocking of the surface was, therefore, sufficient to afford, not merely a qualitative, but also a quantitative explanation of osmotic pressure.

Professor L. Kahlenberg sent in a communication to the discussion on "The Bearing of Actual Osmotic Experiments upon the Conception of the Nature of Solutions."

The occurrence of osmosis and its direction and extent are determined by the nature of the septum and of the liquids that bathe it. Experiments have shown, too, that there is always a major and minor current present, following in opposite directions, although it often appears as if the osmotic process were one-sided. In this case the septum is termed "semi-permeable," and recent research has centred around so-called semi-permeable membranes which really do not exist. The author has demonstrated that it is peculiarly strong selective action on the part of the septum which causes it to be approximately semi-permeable in certain cases, and he has recently even succeeded in separating two colloidal substances by dialysis. This selective action is due to the solubility or insolubility of the substances concerned in the membrane, and therefore osmotic pressure is due to the same forces—essentially chemical in character in the opinion of the author—as the processes of solution, and they may be quite variable as different septa and different liquids are employed. The usually accepted "sieve theory" is untenable, because larger molecules frequently go through a membrane more readily than smaller molecules.

So-called semi-permeable membranes have, of late years, been studied on account of their bearing on van't Hoff's "gaseous pressure" theory of solution and of osmotic pressure. This maintains that as long as the membrane is semi-permeable the osmotic pressure is the same in the case of any septum for a given solution against the pure solvent, a position contrary to experimental facts.

Again, by applying Carnot's cycle and the usual thermodynamic formulæ to the hypothetical case of abstracting, then returning solvent from a dilute solution in a cylinder fitted with a semi-permeable piston, relations have been deduced between latent heats of fusion and freezing points, and latent heats of vaporization and boiling points, assuming the gas equation to hold for dilute solutions. But the results obtained are frequently far from the experimental values found for different solutes in the case of one and the same solvent (in the case of electrolytes), and it has been necessary to postulate either dissociation or polymerization; but the author, referring to his previous papers, considers these explanations are weak and unnecessary. The thermodynamic calculations involve the assumption of a semi-permeable membrane which at the same time is quite passive. As it is selective action which produces semi-permeability, no such membrane can exist. Therefore, thermodynamic osmotic pressure (which is not really osmotic pressure at all) is quite a different thing from that measured by experiment. Finally, to speak of the experimental osmotic pressure of any solution, without mentioning what septum is used to separate that solution from what other liquid, is devoid of meaning.

H. N. Morse communicated tables containing a summary of the recent experiments made by him and Mr. Frazer, with glucose and cane-sugar. The conclusions arrived at are : (1) In the vicinity of twenty degrees the osmotic pressure exerted by either is equal to that which a molecule equivalent quantity of a gas would exert if its volume were reduced, at the same temperature, to the volume of the solvent in the pure state. (2) Between eighteen degrees and twenty-six degrees, at which the measurements were made, both cane-sugar and glucose in solution are in the anhydrous condition. Measurements made just above zero yield pressures somewhat above the calculated gas pressures.

Dr. J. C. Philip thought, with reference to Dr. Lowry's hypothesis, that whatever views might be entertained as to the nature of osmotic pressure, one was bound, on thermodynamic grounds, to conclude that dilute solutions must behave as a gas in relation to concentration and temperature.

J. G. A. Rhodin remarked on the fact that osmotic pressure as usually explained seemed to work in the wrong direction, namely, from the lower in the direction of the higher pressure. It was remarkable, too, that a semi-permeable membrane should conduct electricity so easily. Many of the supposed agreements between calculated and observed results and modern physical chemistry were due to a reckless and unjustifiable use of the method of least squares.

Dr. Alexander Findlay said that on account of unfamiliarity with van't Hoff's theory of solutions there had been much misunderstanding as to what was the problem actually to be investigated. Referring to Kahlenberg's objection to semi-permeable membranes, from the thermodynamic standpoint it did not matter whether there were selective absorption or not, provided the changes in energy were equal in opposite directions. He considered that the quantitative side and the thermodynamic side of the subject had been thoroughly worked out, and the remarkable accuracy of the work of Morse and Frazer, and Berkeley and Hartley, pointed to absolute agreement between experiment and the van't Hoff thermodynamic theory. He did not take kindly to Dr. Lowry's kinetic explanation, and thought that the membrane might be left out altogether, and the diffusion only be-

tween a solution and a layer of pure solvent on the top of it made use of for explaining what took place.

W. A. Davis said that van't Hoff's original hypothesis neglected the influence exerted on the solute by the solvent; Dr. Lowry's modification of van't Hoff's conception was therefore necessary from that standpoint. Osmotic pressure had also been explained as the tendency to equalize the surface tension on the two sides of the osmotic cell.

The Earl of Berkeley disagreed with Dr. Findlay that the thermodynamic was the only logical way of looking at things. He discussed further the discrepancy between the formula used by him and the thermodynamic formula which could be explained on the conception one formed of osmotic pressure.

Dr. T. M. Lowry said that the views he advocated accounted for the negative direction of the osmotic flow referred to by Mr. Rhodin. It was not remarkable that Boyle's law should hold good for osmotic pressure, but it was remarkable that the constant R in the two cases should be identical. The agreement should throw light on the surface structure of liquids.

The chairman emphasized the general applicability of the vapor-pressure method, which, although tedious and troublesome, could be used with any solvent, at all temperatures, and under all pressures. The compressibility of liquids would prevent it agreeing quite with direct measurements; it was therefore important that careful comparisons of the two should be made. In reply to Dr. Findlay, Morse and Frazer's results did not agree with those of Berkeley and Hartley; there was a possible constant error in the former, in spite of the extraordinary accuracy of the work. He hoped more experimental work would be done with living tissues on the line of Pfeffer's original measurements. The term "osmotic pressure," unless merely used in the sense of a pressure required to establish equilibrium, was a misleading one; there was nothing to show that a pressure existed inside a solution in a closed vessel apart from simple gravity pressure. The results of Morse and Frazer brought dilute and concentrated solutions into line, and were a great advance on the van't Hoff treatment; they put the ordinary gas point of view out of court. He deprecated the dogmatic, unscientific treatment to which the whole subject had been subjected for the purpose of bolstering up a particular point of view: the facts needed examination from a broad and critical standpoint.

Data on Electrical Corporations in New York State.

The annual report of the Commission of Gas and Electricity of the State of New York, presented to the legislature January 29, 1907, was briefly summarized in the issue of the ELECTRICAL REVIEW of February 2. Supplementing that summary the following data may be of interest:

The outstanding stock and bonds of operative companies are given as follows:

Classification of Companies.	No.	1903. Stock and Bonds Outstanding.
Coal and water gas	51	$232,901,200
Electric	162	204,348,387
Gas and electric	51	101,406,840
Oil gas	13	43,550
Acetylene gas	12	61,075
Natural gas	41	6,419,850
		$545,180,902

The amounts invested in municipal and individual plants are given as follows:

Classification of Plants.	No.	1906. Amount Invested.
Municipal gas	3	$14,000
Municipal electric	35	877,426
Electric, individual	40	317,774
Oil gas, individual	3	16,268
Acetylene gas, individual	13	25,545
Natural gas, individual	2	500

The amount of coal and water gas sold to consumers and for public lighting was 34,738,143,737 cubic feet, as against 29,569,810,417 cubic feet for the preceding year, an increase of seventeen per cent, and the total amount of gas sold by all companies, including acetylene, gasolene and natural gas is 39,858,755,381 cubic feet, as against 37,914,016,400 cubic feet for the preceding year, an increase of about five per cent.

The number of open arc lamps employed in street lighting by electric companies decreased from 9,191 to 8,605, and the number of enclosed arcs increased from 24,055 to 25,767. There were 50,101 incandescent lamps employed in street lighting.

Long-distance transmission of electricity for general power and lighting purposes at relatively high voltages is increasing throughout the state. The line construction of the companies engaged therein is special as to insulators, poles and safety devices. A list of plants given below enumerates some important details, as of December 1, 1906.

Name of Companies.	System Used.	Voltage of Line.	Conductor Used.	Kind of Insulators.	Line Support.	Power Transmitted. Kilowatts.	Distance of Transmission. Miles.
Niagara, Lockport and Ontario Power Co.	Three phase	60,000	Copper and aluminum	Porcelain	Towers and poles	10,000	165
Herkimer County Light and Power Co.	Three phase	22,000	Copper	Porcelain	Poles, wood	1,200	12
Wetmore Electric Co.	Three phase	22,000	Copper	Porcelain	Poles, wood	350	12
Albany and Hudson Railroad Co.	Three phase	11,000	Copper	Porcelain	Poles, wood	2,200	35
Northern Power Co.	Three phase	22,000	Aluminum	Porcelain	Poles, wood	700	27
Deposit Electric Co.	Three phase	6,600	Copper	Porcelain	Poles, wood	85	10
Carthage Electric Light and Power Co.	Three phase	22,500	Copper	Porcelain	Poles, wood	350	18
Upper Hudson Electric Co	Two phase	11,500	Copper	Glass	Poles, wood	30	6
Utica Gas and Electric Co.	Three phase	23,000	Copper and aluminum	Porcelain	Poles, wood	5,000	40
East Creek Electric Light and Power Co.	Three phase	16,000	Copper	Glass	Poles, wood	600	18
Rockland Light and Power Co	Three phase	16,000	Copper	Glass and porcelain	Poles, wood	200	8
Albion Power Co.	Three phase	6,600	Aluminum	Glass	Poles, wood	350	35
Hudson River Electric Power Co.	Three phase	12,000	Copper	Porcelain	Towers and poles	40,000	..
Niagara Falls Power Co	Three phase	22,000	Copper and aluminum	Porcelain	Poles, wood and concrete	30,000	55

Novel Scheme of Welfare Work of the Brooklyn Edison Company.

There has recently been instituted by W. W. Freeman, vice-president and general manager of the Edison Illuminating Company, of Brooklyn, a far-reaching scheme of welfare work which has hitherto been unsurpassed. This is the institution in the club-rooms of the company of an evening course in electrical engineering for the benefit of the male members of all departments of the company. The course consists of high-grade experimental lectures, such as are given in technical institutions, covering the elements leading up to electrical measurements, direct and alternating currents. Sydney W. Ashe has been retained as professor in charge, and he is assisted by A. S. Hegeman, of the Brooklyn Polytechnic. Four lectures have so far been given and the interest manifested has shown the great value of the work. The meetings are held every Tuesday evening.

This course was made possible in a large measure by Mr. Freeman and W. T. Wells, general superintendent, and its success was due in large measure to W. T. Fairburn, chairman, and G. N. Kebbe, of the Edison Club committee.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

The Differential Electrodynamometer.

The differential electrodynamometer, devised by Potier, has some advantages over the usual instruments for measuring current and power in alternating circuits, in that it is independent of frequency and wave-form. The device consists of three coils connected in series. Two of these are stationary and are exactly equal, and wound so that each neutralizes the effect of the other. The third coil is movable and placed about the other two in the usual position. In use the three coils are connected in series in the circuit which is under investigation, and a non-inductive resistance is connected so as to shunt one of the fixed coils and the movable one. In this way an extra current will flow through the remaining fixed coil, thereby setting up a torque upon the movable coil, which will be proportional to the power in the circuit. Careful tests made of this instrument by H. Tellier have shown that it gives very reliable results, even with exceedingly irregular wave-forms.—*Translated and abstracted from L'Industrie Électrique* (*Paris*), *January* 25.

Electric Cranes at the Middlesborough (England) Docks.

Important additions have been made recently to the large shipping docks of the Northeastern Railway, at Middlesborough, England. These docks, when first constructed, made use of hydraulic cranes, but twelve years later, in 1903, these were replaced by electric cranes. The extensions to the dock have now been finished, and it probably has the most complete electric crane and capstan equipment in existence. Power is furnished for these from a power-house situated on the dock side. It is distributed throughout a network of underground cables laid solid and supplying about sixty crane-connection boxes, into which the cables running to the cranes are plugged. There are nineteen three-ton, ten five-ton electric cranes, and twenty-six one-ton pull capstans. The three-ton cranes have a radius of jib of forty-four feet nine inches. The height of the jib top is sixty feet from the quay level. The speed with a three-ton load is 150 feet per minute, and 250 feet a minute with one-half this load. The lifting motor is rated at fifty horse-power, and the revolving motor at eight horse-power, which gives a revolving speed at the hook of 400 feet per minute. The cranes are of the high gantry type, allowing trains to pass under them, and are moved by electric motors at a speed of about thirty feet in three minutes, allowing for changing the connections. The lifting motor is fitted with a band brake controlled by an electromagnet. The brake may also be operated by hand from the operator's cabin. The crane is provided with portable lamps and with plugs for connecting in instruments for inspection. The ten-ton cranes are similar in design, though heavier. The slewing motor is rated at twelve horse-power, and the lifting motor at sixty horse-power. The latter is both single and double-geared to the lifting barrel, suiting it to lifting loads up to two and up to ten tons, respectively. The electric capstans are operated by twenty-four-horse-power motors, shunt-wound, running at 1,100 revolutions per minute, and capable of exerting a steady pull of one ton at a speed of 200 feet per minute, and of hauling a load of 100 tons on a level road. The capstan head is driven through a worm and wheel, both submerged in oil. An automatic mechanical brake is attached, which is released when the motor starts. The motor is controlled by a switch working through a pedal placed on the cover of the manhole, so that one operator can control its entire working.—*Abstracted from the Electrical Review* (*London*), *February* 8.

Notes on Rheostat Design.

Rheostats are divided by F. D. Hallock into two types—the open type and the embedded or enclosed type. In the former the resistance material is open to the air and easy of inspection and repair; in the latter the material is embedded in some substance such as enamel. These rheostats, unless they are small, are difficult to repair, and occasionally cause trouble through absorption of moisture. The resistance material is selected according to the type of rheostat. There are several materials available, but, in general, an alloy having a negligible temperature coefficient is desirable. For starting rheostats, however, a resistance material with a considerable positive temperature coefficient is not a disadvantage. Materials having a negative temperature coefficient are generally to be avoided, and where an automatic decrease in resistance is desirable, some other method of attaining it should be adopted. Resistance units capable of being easily assembled are preferable, and the sizes of these units should be determined by mechanical as well as electrical considerations. A small number of units may be used for a large number of rheostats. A large range in size may be covered by two units wound with wire and three grid units. For starting service it may be assumed that the entire energy absorbed in the resistance has not time to be radiated during the start; hence the energy absorbed is equal to the heat generated; and from the physical constants of the resistance material the proper size of wire for any given current and time of starting may be computed. The data thus obtained should be plotted in curves, showing for the several units the limiting starting current for any starting time. In starting, it is necessary to proceed in steps, in practice the number being from three to ten. For small motors fewer steps may be employed than for large. For selecting the size of steps an acceleration curve for the motor may be used, since this curve also represents the counter-electromotive force of the motor. The first step is determined by the resistance necessary to limit the current to the value desired when the motor is standing still. The other steps are determined in the same way, the electromotive force considered being the difference between the applied and the counter. The steps should be proportioned so that fluctuations in the current will be uniform when the rheostat arm is moved from step to step in equal time intervals. The standard lines of starting rheostats are designed for a certain load. While some variation is allowable, the rheostat which is too large for the motor it is to start will have too little resistance, and subject the motor to too much current. Likewise, a rheostat which is too small will not allow sufficient current to pass until several steps have been passed, and the motor thus has only two or three steps remaining to start it. The motor with a

starter having a comparatively large number of steps is capable of better performance on a wide range than one of few steps, since if the motor does not start on the first step, the rheostat may be moved to the second or third without starting the motor with a jerk. Advantage of radiation may be taken when rheostats are used for continuous service. The temperature of the wire will be that at which the heat developed is equal to the heat radiated. It is best to give the rating of rheostat units for continuous service in watts for the same thermal conditions; then, no matter what piece of apparatus is under consideration, it is dissipating a certain number of watts per square inch of surface when the rise in temperature is a certain number of degrees above the surrounding air, and it can not get rid of any more heat until the difference of temperature is increased, unless artificial cooling means be employed. No matter what the material or its form, the ultimate temperature which it will stand without failure can be estimated if its rating in watts is known. Curves of standard units should be plotted, giving the temperature rise when a certain number of watts is being radiated. From these the proper unit for any particular condition may be selected. In the design of field rheostats, tapered resistances may be used—that is, the first step may have a higher capacity in amperes than the next. In laying out a tapered resistance for a low-voltage line, the next highest resistance unit may be inserted without exceeding its capacity sooner than on a high-voltage line—that is to say, a field resistance for a 200 or a 500-volt motor may be used on 110 volts so long as its first-step capacity is not exceeded, while the reverse is not true. The hot and cold resistance of shunt fields varies about twenty per cent. This must be allowed for when selecting a rheostat. It is important to bear in mind the manufacturing facilities when selecting a design, as the type may be determined by the tools available.—*Abstracted from the Electric Journal (Pittsburg), February.*

The Arc and the Spark in Wireless Telegraphy.

Until recently most of the energy devoted to developing wireless telegraphy was concentrated on improving the receiver. Now that attention is being given to the sending apparatus, it is probable that considerable advance will be made. It is this feature of the arc that is dwelt upon here by L. B. Walter. There is much discussion of undamped oscillations, but the author points out that this term is a misnomer, and that "forced" or "sustained" oscillations would be more correct. That they are but little damped, even in the influence of the steady arc, is highly probable, and that the succeeding discharge follows before the damping has become pronounced, is also probable. To this, in a great measure, the excellent results obtained by the newer methods may be ascribed. It has been said that the Poulsen arc used for setting up high-frequency oscillations is not a true singing arc. This is a point which can be decided by experiment alone, but Benischke considers that the chief result of the hydrocarbon atmosphere surrounding the arc and of the magnetic field is that the maintenance of an arc with the ordinary potential difference between the electrodes is thereby rendered impossible, and the potential difference has, in consequence, to be raised, thus increasing the energy supply on which the shunt circuit can draw. Even though it be granted that all the advantages of continuous undamped oscillations are realizable in full measure, the author is inclined to differ from those who believe that spark telegraphy is doomed. For certain purposes—naval and military—this may be true, to some extent, and for commercial purposes also to some considerable degree; but spark telegraphy can hardly be said to have entered upon that phase. So far as wastefulness is concerned, the advantage does not lie on the side of the arc method; and the method of signaling by striking the arc afresh for each separate signal, while more economical than continuous burning, is not practicable, since it would limit seriously the available speed of transmission and also the permissible resistance of the oscillating circuit. The average ratio of the energy in the arc circuit to that in the oscillating circuit is seven to one, according to Poulsen, giving an efficiency of, roughly, fifteen per cent. The frequency at this efficiency is said to be about 350,000. At 160,000 the efficiency is twenty-nine per cent. At 50,000 it is fifty per cent. If these figures be plotted it will be seen how rapidly the efficiency decreases with an increase of frequency. For frequencies far below 350,000 the efficiency is very low. It would be interesting to know whether the curve of efficiency, after first dipping down with an increase of frequency, finally takes a turn upward, and at what point. An important point has been demonstrated by Sahulka. It was found that oscillations occur in the choking coils placed in the supply circuit, and that these are of a frequency differing from that of the oscillating circuit. To avoid the presence of two sets of oscillations it is necessary to make the self-induction of the coils in the primary circuit small, and to put a small self-induction in series in the arc circuit, which is chosen so that the two discharge paths of the condenser correspond to the same frequency. Incidentally, this discovery seems to permit of increasing the efficiency, since a secondary winding may be placed around both, and the self-induction coils connected in series with the ordinary secondary oscillating circuit, a condenser being placed in parallel with the arc series self-induction. Attempts have recently been made to eliminate the so-called inherent disadvantages of spark telegraphy. The chief of these drawbacks is the comparatively lengthy inactive interval between the initiating spark of one wave train and the last oscillation of effective amplitude in the preceding wave train. Two attempts at the solution of this problem have been made, one by Eisenstein, and one by Sahulka. In the first the chief feature is the employment of three-phase supply current. The primaries of three transformers or induction coils are connected between the three wires of the supply circuit and the starting point, so that the current from each phase passes through the three windings in turn and starts discharges on the oscillatory circuits across the spark gaps, one after the other. By this means the transmitter may be kept practically constantly excited. Sahulka seeks to accomplish the same purpose by mechanical, in place of electrical, means. He has pointed out that the chief cause of the long inactive interval between the wave trains in ordinary spark telegraph transmitters is that during the whole time the spark lasts the source of current is practically short-circuited, and hence its potential difference is reduced to zero and can increase but gradually on the spark ceasing, owing to the inductance of the circuit and the necessity for charging again the condensers in the oscillatory circuit. To overcome this defect he uses a rotating commutator of special construction. This differs from the rotating commutator devised by Tesla and Braun, in that two condensers are used, which are alternately connected to a source of current for charging, and are next disconnected and then inserted in the oscillatory circuit. Thus, while one condenser is giving up its discharge, the other is being charged. The breaks between separate wave trains may in this way be made very short. This method, however, appears suitable for small power stations only.—*Abstracted from Electrical Engineering (London), February 7.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

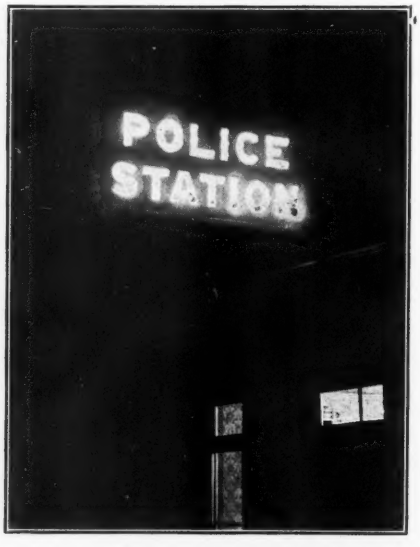
EDITED BY CHARLES A. PARKER.

Analyzing the Needs of Consumers.

THE WAYS AND MEANS OF MEETING THEIR REQUIREMENTS.

Don't bank too much on your satisfied customer. Beneath his apparent smiles there may be rankling the sharp thorn of some grievance; and no matter whether it be real or imaginary, he has got to have somebody to lay it to. You won't have to resort to any necromancy to figure out who is going to be the victim.

Wait a moment; perhaps you are bringing trouble down on your own head. Ostensibly you are not, of course; unwittingly you may be. Are you complacently allowing your customer, for want of proper



Most solicitors would hardly think of a police station as a probable customer for an electric sign, but in reality they are easily converted to the use of an electric sign by an aggressive new-business department.

advice, to use current extravagantly? Are you loading him up with a lot of light or power he doesn't really need?

The day of reckoning is coming, after a spell. One of these fine Tuesday mornings your overloaded customer is going to sit up, dig his fists into his eyes, and ask "Why?" Then, likely, it is going to be too late for you to explain, and your customer, whether he continues to use your current or not, has had, in that moment, implanted the germ of suspicion, which is not the pleasantest sort of a germ for culture in a customer. It destroys his confidence. It liberates his proclivity for fault-finding. It transforms him into a whimsical creature. It makes him finicky, uncertain, contentious.

As a sordid dollars-and-cents proposition the central station may not consider it its duty to dissuade overzealous customers from using current extravagantly. The central stations may argue that their customers know their business better than anybody else, and that if they are disposed to use electricity, let them do it whether it be much or little—with a secret leaning towards the "much."

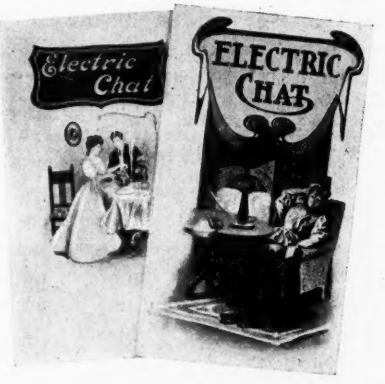
Such reasoning may apply properly enough to the purchasing of groceries, meats, clothes, etc., because folks have a tolerably good idea of just what they need in these lines. But electricity is a horse of another color: It is a product little understood by the people. It is new. It is strange. Folks must be tutored in its uses. They must be taken by the hand and the way pointed out.

Would you have your people learn the lesson by tedious and costly experience? Would you regard them as explorers? While they are trudging along, groping in the dark, they are pretty certain to bump up against many sharp corners, with prejudicial frequency, and with a promising chance of becoming discouraged, and throwing up the whole thing as a bad job.

Electricity knocks at the door of home, store, shop; offering its services as a willing slave, when properly handled; yet it plunges down the street, wild and ungovernable, like Diamedes's mares, when unharnessed. You are the one to tame the steed. It is your province to turn it over to your people, already subdued, or to be prepared to point out the means to them.

The time is coming when the public will not need such lessons. Every customer will know the amount of electricity he needs for a given purpose. Where he may be burning two lamps to-day he will discover that one will answer his purpose. He will find, sometimes, that he has been burning lamps of too great power in his signs, or porches, or corridors, or closets, or other places where small candle-power lights would be equally satisfactory, and appreciably cheaper. It will come to your customer, when he gets a little better acquainted with electricity, that he can use turn-down lamps in sleeping apartments, bath-rooms, basements, halls, clothes closets and kindred places where bright lamps are not always necessary, and only eat up needless current.

Are you going to wait leisurely for him to find out these advantages himself, and



Such effective pieces of advertising are being sent out with each monthly statement by numerous central stations. They are made to fit small-sized envelopes.

after he has stumbled against the truth, look back at you and sorely wonder, and wonder, and wonder? It's wrong. It spoils confiding customers. It shows your cold lack of interest in the welfare of your people. Your interests are not their interests if you indulge in such selfish tactics.

And while we are passing, would it not be a wise course to advocate the placing of day-load devices on separate circuits, thus giving customers who make use of these devices during the day a better rate?

There are devious ways by which the central station could proffer a helping hand to its present customers.

The common people have too long regarded the central station as a self-elected sort of deity, perched high up on an exalted throne of its own making, with a halo of the same brand dancing about its head—a being to be beheld at a distance.

What's the matter with stepping down where the rest of us live, smashing the halo, and proffering the hand of good fellowship to mere mortals, in a commend-

able endeavor to work hand in hand with them, to save them money?

What's the matter with the central station deputizing a representative to call on a customer who may be using superfluous current, and after looking over the situation, suggest to this customer that he is spending money needlessly?

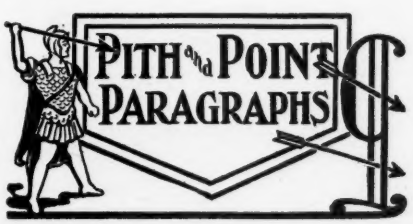
The regard in which that customer held the central station after that would not resemble his attitude before.

People would look more kindly on such a central station. People would be able to see, in its acts, honest human interest.

While we can't get away from the mathematical surety that to decrease a patron's current expense would likewise decrease the central station's revenue, temporarily, the great, irresistible fact remains that that customer would think infinitely more of the central station; and his talk, as he circulated among acquaintances and friends, would partake of the nature of boosts instead of the knocks now so generously rampant.

It pays. It doesn't pay because it is sentimental, or purposeful, or kindhearted. It pays because it attracts more dollars and cents from old customers, who are volubly satisfied, and from new customers who have heard the old ones talk.

The central station has a brilliant future ahead of it. Some central stations seem to imagine that their future is behind them. It is true, too. It's just as true as it is foolish. It's just as foolish as it is needless. To be universal is to have a centre everywhere, and a circumference nowhere. Get a centre and stick.



Under this heading we shall, from week to week, present to our readers a little series of inspirational aphorisms (original, aboriginal and selected), which will, we believe, prove stimulating and suggestive to those who are interested directly or indirectly in the sale of central station current.

Hustle, hustle. Then hustle some more.

Your customer may know something of current; you should know more. A little learning is a dangerous thing.

Your customer may state facts; if incorrect you should be able to refute them. Therefore, study current in all its phases.

Remember some people are opposed to private corporations. Show them the superiority of private over municipal electric light plants.

Be ready to quote figures. Do not misrepresent. It isn't necessary—the arguments are all in your favor. That's where you come in. Point it out to him.

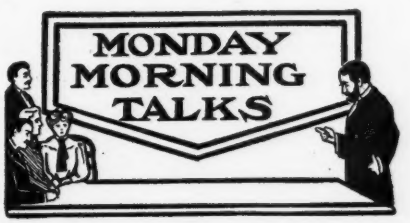
Most people are better lead than driven.

No matter how good a solicitor you may be, there is always something to learn.

It doesn't pay to talk politics or races with your prospective customer—talk electricity.

Gain the confidence of your prospective customers by being just and honorable. When you're up against prejudice, remove the cause—you'll destroy the effect.

When talking to a customer do not ask personal questions about his business. Gain his confidence by being affable, yet businesslike. Be cool and collected at all times. When talking electricity be enthusiastic. Be half-hearted and your prospective customer will think that you do not believe your own arguments.



Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

From where I sit it begins to look to me that some of you fellows have got an idea in your heads that certain men can not even be approached—much less landed for a current contract.

Get disillusioned at once, boys! The sooner the better. That's the most fatal streak you can get into your entire make-up, and until you get rid of it, you'll never make a successful salesman.

Report after report has come in lately from different salesmen that Mr. So and So can not be seen.

All a mistake, fellows. Any business man alive can be seen if you go at it right. If fair means won't get you past officious stenographers and attendants into the private sanctum—why, resort to strategy if necessary. There's more'n one way to skin a cat, and there's more than one way of reaching a man who is too busy, or doesn't care a rap about your proposition.

Remember, it's your business to get him interested whether he is or not. Simply because several of you have tried to see a certain party and failed is no reason why you should be afraid to tackle him again.

Unbeatable?—nothing!

Let me cite a little experience I had once. Several years ago in Chicago I was sent out to land a certain doctor who was a good prospect for current. Every one of the six salesmen before me had failed to even reach his private office, due to the intuition of the lady attendant in divining their errand. She was simply unbeatable, they admitted. Fortified by their experience, I knew I would have to resort to some clever bluffing to get past this attendant and see the doctor, so I took my cue from his love of surgery.

There were about a dozen patients in the outer office when I arrived, so quick action was imperative.

"I am Mr. A——," I told the attendant quietly, but with some pretence of hurry. "Ask Dr. —— if he will see me for a moment about that operation."

"What operation?" she asked. "Oh, he will understand," I answered her. "It will only take a minute, and I can't wait."

She went into the private office and ten seconds later the doctor appeared at the threshold trying to recall me. He couldn't, of course. He beckoned me in, and I gave his hand a vigorous squeeze as we crossed the door. At that instant I had no idea how to handle him, but his brisk interrogation, "What operation was that?" gave me my cue.

"The operation," I replied, with a broad smile playing all over my face, "is by the aid of this contract you amputate a few dollars a month from your bank account, and graft electric current on those drills of yours and increase your income."

Well, for about five seconds he was mad. Then my audacity amused him, and, dropping into his chair, he laughed and laughed.

That broke the ice, of course, and inside of half an hour I had his signed contract in my inside pocket, and he shook my hand very warmly at parting.

Well, boys, my manager kept that order on the bulletin board for fully a month

to show that "where there's a will, there's a way to reach every man alive."

Hope you get the moral to this, fellows.

As Emerson says: "No one can cheat you out of ultimate success but yourselves."

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

W. E. Russell, president of the Massillon (Ohio) Light and Power Company, is a firm believer in advertising and new-business-getting along the most modern lines, and has spared no pains or expense to acquaint the people of Massillon with the manifold advantages of electricity over all other illuminants and as a source of power and heat. Especially has he been successful in warding off gasolene competition, which, as is well known, has long been one of the bugbears of the central station managers in the smaller cities.

One of Mr. Russell's plans, which if he did not originally invent, he is at least one of the strongest exponents of, is that of calling into requisition the services of a clipping bureau and keeping constantly in front of the people the many and terrible results of accidents due to explosions of gasolene and similar dangerous sources of illumination. The clipping bureau furnishes day by day items culled from all over the country, and these are reproduced in the local newspapers in Massillon as straight reading matter and are also sent out with the company's bills, and worked in effectively in numerous other ways.

Mr. Russell has seen many evidences of the value of his campaign work against the use of gasolene. Not long ago a valuable church contract was secured for his company through the report which had appeared in the Massillon local papers a few days previous to the awarding of the contract of the destruction of another church by an explosion of gasolene.

Mr. Russell has met in his work with considerable success along the lines of reaching out for business to smaller towns and villages on the outskirts of Massillon, and this would seem to be a field well worthy of cultivation by the central station manager who can afford to make some reasonable investment in extending his lines. A case in point was that of a small township which had a municipal plant that had practically gone on the rocks. The Massillon company took the contract for the public lighting of this town at a fair figure and immediately proceeded to secure a very nice quantity of commercial accounts, which have made the investment so far an exceedingly profitable one.

Some little time ago the gas street lighting people made a determined effort to compete for the lighting of the streets and had some very plausible arguments for their smaller units, especially for the suburban lighting, with the result that the city fathers were inclined to think seriously of letting them get in, but the electric company were able to hold their own by using in the suburban districts and at alley entrances a number of fifty candlepower "Gem" high-efficiency lamps, which were burned in a series of arc lamps. This is a wrinkle which every central station manager will, we are sure, be glad to know of; and Mr. Russell, we are also sure, will be glad to furnish further details to any interested parties.

Mr. W. E. Russell, president of the Massillon Light and Power Company, whose liberal commercial policy has resulted in the steady growth of the company.

Before the advent of the new-business movement of advertising, solicitors, etc., for central stations, almost every manager had a certain system or plan of his own for furthering the sale of current—some good, some bad, some indifferent.

Mr. Westover, of the Cadillac Water and Light Company, of Cadillac, Mich., conceived the idea of enlisting the cooperation of every person in the employ of his company to educate the people of Cadillac in the use of electric current. Office boy, linesmen, engineer, etc., all played the part of constant solicitors. Every person they met or talked with was sure to hear something of the advantages of electric light, electric power or the numerous electric devices.

Another piece of good business policy on the part of Mr. Westover was in securing the friendship of his fellow townsmen. At one time a large number of men were out of employment in Cadillac, owing to strikes, etc., and he put them to work laying water mains. For their services he gave them credit in water taxes. For this he received a widespread amount of free advertising, and the town could not do enough for both his water and electrical plant. Every person who could possibly afford to burn or use electric current was only too anxious to do so.

The Portsmouth Street Railway and Light Company, of Portsmouth, Ohio, must be credited with some very excellent new-business work during the past several months. Campaigns of direct-by-mail advertising have been persistently maintained, and these have been directed towards every class of consumer—residences, merchants and power business. One of the recent pieces of advertising issued by this company was in the form of a very attractive mailing card containing on one side an illustration in colors showing the exterior of a house. Through breaks in the wall could be seen small illustrations showing various domestic uses of electricity, such as a chafing-dish, flat-iron, electric light, etc. The card was cut out in the shape of a house, and made an attractive and noteworthy advertisement. On the other side of the card illustrations were shown of various devices, and a strong talk on the advantages of electricity was directed at the mind of the property owner and householder.

Car-Building Company Combine.

All the electric car-building companies controlled by the Brill interests, it is announced, have been merged in a new holding company, called the J. G. Brill Company, capitalized at $10,000,000. The new company assumes all the obligations and contracts of the old concerns and takes over the entire capital stock of the American Car Company, of St. Louis; the G. C. Kuhlman Car Company, of Cleveland, and the John Stephenson Company, of Elizabeth, N. J. Its principal officers are: president, James Rawle; vice-president, John A. Brill; second vice-president and general manager, Samuel M. Curwen. The headquarters of the company will be in Philadelphia. The merger has nothing to do with the proposed ultimate merging into one great company of all the car-building concerns in the United States.

INDUSTRIAL SECTION

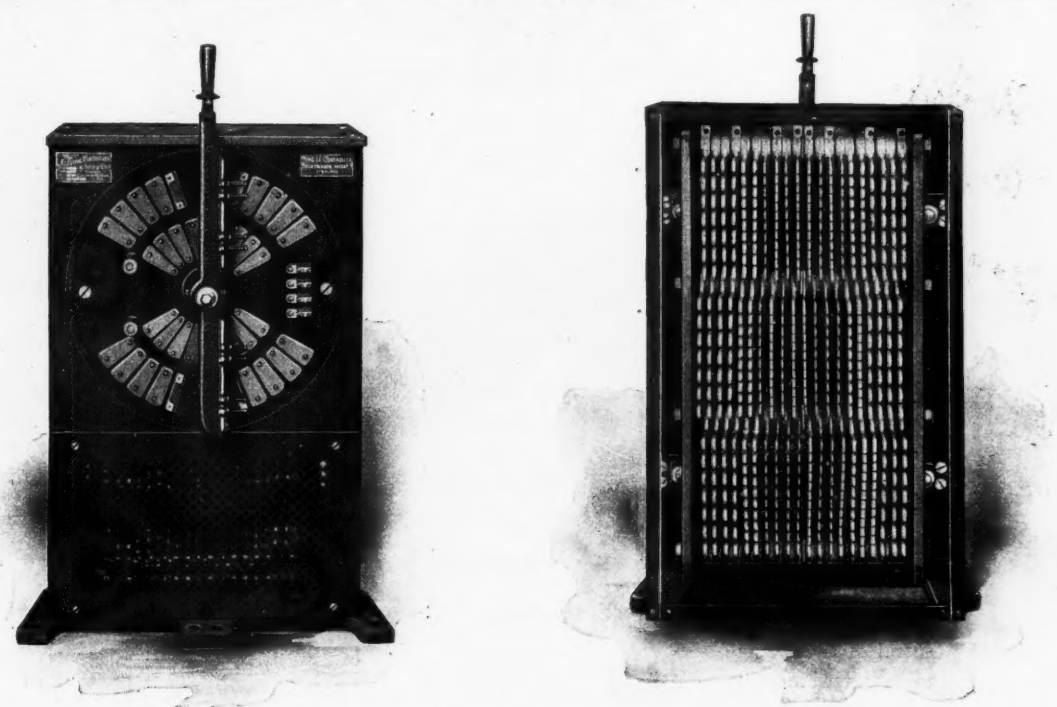
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Line of Controllers.

The Electric Controller and Supply Company, Cleveland, Ohio, is placing on the market a new line of controllers termed type "G" which have a rating of from one to fifty horse-power. These controllers were built to meet the requirements of general crane service where the conditions are not severe enough to demand the use of the Dinkey ventilated controller. The type "G-3" and "G-4" controllers are built with coil resistance and the type "G-5" and "G-6" controllers are built with cast-grid resistance. When it is desired to place controllers above or in the rear of the operator the type "G" controller is furnished arranged for under-lever operation. They are also furnished with spring return for operation from the floor by means of pendant ropes or chains. A number of crane users have decided that a fifteen or twenty-ton crane requiring a twenty-five or thirty-horse-power motor on the hoist and bridge motion may be operated from the floor by any of the men in the shop, thus saving the wages of a crane operator who would probably be idle half his time. It is a very simple matter to put cut-outs at either end of the trolley travel and at either end of the run-way to prevent accident. The type "G" controller meets this demand for a controller up to fifty horse-power arranged for operation from the floor by means of ropes. This controller is a self-contained unit, the resistance being placed in the frame, making it necessary to run only four wires between the controller and motor. Reversal is accomplished by the use of a single lever, no separate reverse switch being required. The type "G" controllers are self-contained, compact and accessible. All parts are made to jig and are interchangeable. The contact face is of heavy slate free from metallic veins. The contact segments are of copper, which are screwed to brass lugs, to which all wiring connections are made. By this construction any of the contact segments can be removed and replaced without disturbing the wiring connections. The contact arm is of soft cast-iron and carries the fingers and finger holders, the insulation of which is of heavy pressed vulcabeston bushings. The contact fingers are of drop forged copper of great hardness and may be removed and replaced without removing the contact arm. A powerful and effective blow-out is provided in all sizes of these controllers.

The frame for type "G-3" and "G-5" controllers consists of a main casting in one piece provided with a cover, the removal of which affords easy access to all resistance connections. The case enclosing this frame is of perforated steel, thus allowing ample ventilation. The frame of the "G-4" and "G-6" controllers consists of a bottom casting which supports the resistance and a top casting which supports the contact slate and arm. The top and bottom castings are connected by means of four steel corner posts around which a casing of perforated steel is provided for ventilation and protection to resistance. The top casting of the "G-4" and "G-6" controllers supports the contact slate, which is completely covered and protected by a sheet-steel casing. This protects the operator from coming in contact with any live parts of the controller and also protects the working parts of the controller from dust and dirt.

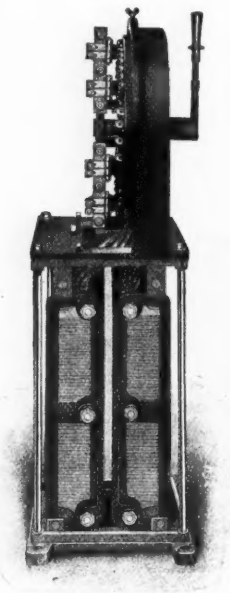
Easy operation is secured by a lever which is keyed to the arm shaft at the back of the top casting, which gives a short movement of about ten inches in



FRONT AND REAR VIEWS OF TYPE "G" CONTROLLERS—WITH CAST-GRID RESISTANCE.

either direction for both starting and reversing.

The resistance for the "G-5" controller is built of cast grids in a single bank, which may easily be removed as a unit without disturbing the other parts or moving the controller. The resistance for the "G-6" controller is made of two banks supported on bars attached to the frame, and may be removed in separate units without disturbing the other parts. The



SIDE VIEW OF TYPE "G" CONTROLLER—WITH COIL RESISTANCE.

resistance for the "G-3" and "G-4" controllers is made up of type "E" coils, which consist of a heavy asbestos tube stiffened by means of a central brass tube which serves to bring the rear terminal forward, facilitating the necessary connections.

These controllers are very adaptable for service up to 500 volts. Six points of control are provided with the "G-3" and "G-5" controllers, and eight points of control with the "G-4" and "G-6" controllers.

A Common Battery Ballast Multiple Switchboard.

One of the most interesting exhibits at the recent electrical show held at the Coliseum, Chicago, Ill., was the complete section of the 3,000-line common battery ballast multiple switchboard being built for the Minto Light and Power Company, Minto, N. D., by the Vote-Berger Company, La Crosse, Wis.

The frame of this board, giving a good idea of its appearance, is shown in Fig. 1. The operation of this board is unique and gives promise of wide and successful installation. The prominent feature of the design of the board is that of simplified circuits. When compared with the ordinary relay board circuits the difference is remarkable.

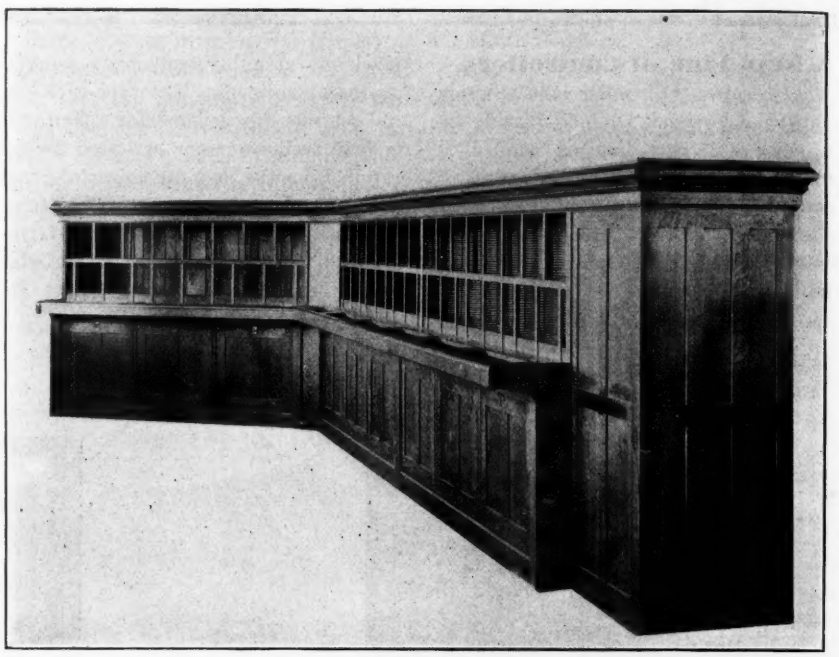


FIG. 1.—FRAME OF VOTE-BERGER COMMON BATTERY BALLAST MULTIPLE SWITCHBOARD.

In this board there is only one operation in the lamp circuit, shown in Fig. 2. This is merely lighting the line lamp through a straight series circuit. The action is positive and direct. In the cord circuit, as shown in Fig. 3, there is only one operation to control the supervisory lamp. The shunt placed across the cord gives battery current to the supervisory lamp direct, without the use of any coils or auxiliary circuits. The act of taking the telephone from the hook shunts out this line directly.

In operating this board there are eliminated a number of possibilities of trouble. Due to the simplified circuits, the number of soldered connections is reduced to a minimum. The ballast board has merely

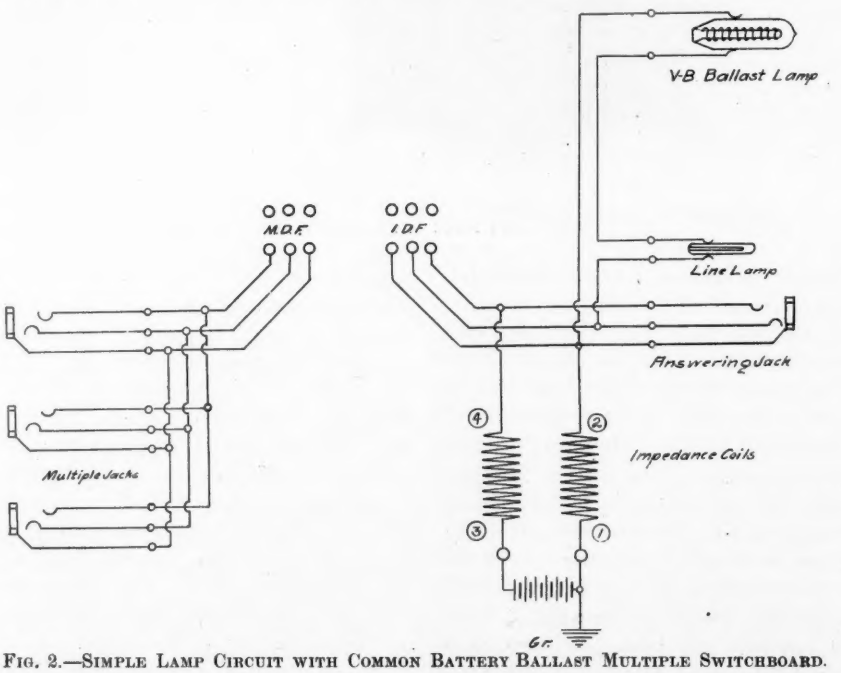


FIG. 2.—SIMPLE LAMP CIRCUIT WITH COMMON BATTERY BALLAST MULTIPLE SWITCHBOARD.

a straight series connection through the line and through the cord circuit.

Fig. 4 shows the ringing keys made for this board, and indicates with the frame, shown in Fig. 1, the compactness and fine appearance of this apparatus.

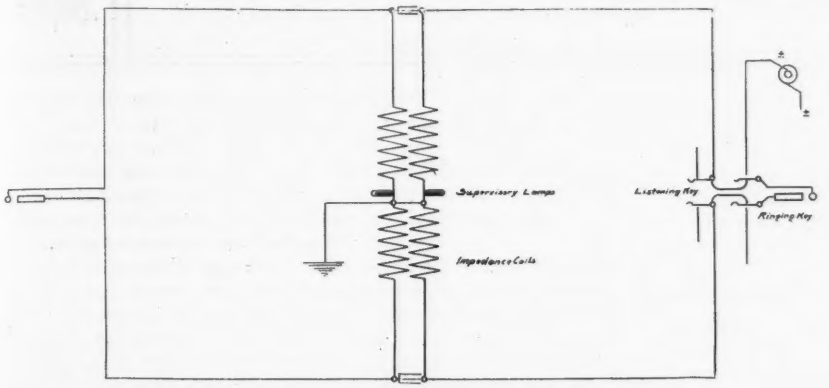


FIG. 3.—CORD CIRCUIT WITH COMMON BATTERY BALLAST MULTIPLE BOARD.

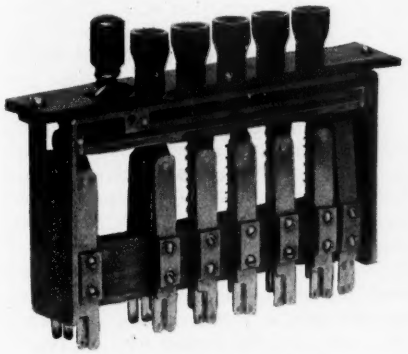


FIG 4.—RINGING KEYS WITH VOTE-BERGER COMMON BATTERY BALLAST MULTIPLE BOARD.

All of the operating parts of this board are rigid in construction and are exceedingly accessible for repairs. The maintenance expense of a board of this type should be far below that of a board of the ordinary construction. From the way in which the present equipment is being developed and worked, it is reasonable to expect that this apparatus will become very popular.

Street Railways that Cross State Lines Subject to Rate Law.

The Interstate Commerce Commission has made a decision that street railway companies that cross state lines are subject to the provisions of the new railroad act. The traction companies of Washington, whose cars run into both Maryland and Virginia, have been notified that under the law they can no longer issue passes covering transportation outside the limits of the District of Columbia.

The "Security" Snap Socket.

A new socket, known as the "Security" snap socket, which does away with the inconvenience of the screw-fastened type, has recently been perfected by the General Electric Company, Schenectady, N. Y.

DISUNITING THE "SECURITY" SNAP SOCKET.

Such a device has been particularly needed in fixture work, where it is very inconvenient to adjust an ordinary screw-jointed socket in the husks. Moreover, the "Security" snap socket is so constructed that it is not necessary to tip the shell to make the fastening. It may therefore be used in small husks as conveniently as in large.

THE "SECURITY" SNAP SOCKET ASSEMBLED

Reference to the accompanying illustrations will make the construction of the new socket clear. The security of the bayonet joint is combined with the convenience of a spring snap connection. In order to facilitate the assembly of the socket the cap and shell are marked with arrows and a star. To disunite the socket the thumb is pressed on the star, the arrows brought into line and a straight pull brings the socket apart. In assembling, the cap and socket are arranged with the arrows in line, the shell is inserted in the cap and turned until the socket locks.

THE "SECURITY" SNAP SOCKET DISUNITED.

As the shell is fastened by three bayonet-joint catches, the connection is rigid and the joint is held securely by the automatic lock.

The Wire and Telephone Company of America Suffers from Fire.

The fire which destroyed one of the factory buildings of the Wire and Telephone Company of America, at Rome, N. Y., on the twenty-third, will in no way interfere with its taking care of the requirements of the trade as heretofore. Owing to the resourcefulness and quick action of the company, every provision has been made to make deliveries and to accept new business on all of its products. The fire, which destroyed only the wire-drawing plant, was no sooner under control than arrangements were being made for the drawing of its wire by other mills. Representatives were instructed to accept orders and assure customers of deliveries as though there had not been the misfortune of a fire loss. The buildings in which the company manufactures magnet wire, rubber-covered wire and telephone products, were not damaged in the least, and operations have been resumed. The Wire and Telephone Company of America has already made contracts for the erection of a new wire-drawing plant, which will be pushed to the earliest possible completion, and will afford a greatly increased capacity.

Current Electrical News

DOMESTIC AND EXPORT.

TO BUILD NEW POWER PLANT—The Guanajuato Power and Electric Company, of Colorado Springs, Col., operating a $1,500,000-power plant in the Mexico mining district, will at once begin the construction of a similar plant on the Rio Angulo in the state of Michoacan, Mexico. The construction will take about a year. A third plant to be built in the same vicinity will bring the total horse-power of the company's plants to 17,000.

PROPOSED $3,750,000 BOND ISSUE—The directors of the Bell Telephone Company of Canada will ask shareholders for power to issue bonds or debentures to the amount of $3,750,000 for general extensions in connection with handling the company's increasing business. The proposed increase will bring the total bond issue up to the full limit, $7,500,000, all that is authorized upon the stock capitalization of $10,000,000. As many extensions are projected, it is expected that a further stock issue will shortly be made. The company is now seeking the right to increase its capital to the $30,000,000 mark.

LONG SAULT RAPIDS TO BE HARNESSED—The Long Sault Rapids on the Grand river, Quebec, Canada, are to be harnessed in the near future. It is said that representatives of large capital supposed to be in close touch with the Pittsburg Reduction Company, which owns the Massena Power Company, have acquired options and made a first payment on the whole of Bernhart's Island and a portion of Long Sault Island and are looking after the property at the foot of Specks Island on the Canadian side. Rumor credits the projectors with the intention of damming the channel of the South Sault and possibly a part of the main Sault as well.

LANCASTER COUNTY RAILWAY AND LIGHT COMPANY REORGANIZED—The Susquehanna Railway, Light and Power Company, with an authorized capital of $30,000,000, will succeed the Lancaster County Railway and Light Company, Lancaster, Pa. The new company, in addition to owning the traction, electric light and gas companies in Lancaster county, owns gas and electric properties in eleven leading cities. Arrangements have been made to build electric lines from Christiana to Parkesburg, to make a through connection to Philadelphia; from Mt. Joy to Middletown, for through service between Lancaster and Harrisburg; from Manheim to Lebanon and from York to Columbia, across the Pennsylvania Railroad bridge. These extensions will cost $1,500,000.

SYRACUSE LIGHTING DECISION RENDERED—The application of the Syracuse (N. Y.) Lighting Company for consent to increase its capital by $5,000,000, and to lease its property and franchises to the Onondaga Lighting Company, has been denied by the state gas commission. The terms of the proposed lease were to have been granted by the United Gas Improvement Company of Philadelphia. The state commission also denied an accompanying application of the Onondaga Lighting Company for authority to transact business and to issue $1,000,000 capital stock. The state commission disapproves the proposed lease on several grounds, mainly that it is in opposition to public policy to permit further issues of common stock under it by the Syracuse Lighting Company, as provided by the proposed lease for improvements and extension. It is held that the contemplated returns to be paid upon these securities would impose an excessive burden on the community and prevent any future regulation of the price of gas and electricity in Syracuse. The lease would also prevent future supervision by the state of the important interest of the companies.

NEW LIGHTING PLANT FOR KANSAS CITY, MO.—Naming William F. Lyons as the grantee, Alderman John F. Eaton has introduced an ordinance in the upper house for a thirty-year franchise for an electric light, heat and power plant. Without debate the ordinance was referred to the light committee of the house. Mr. Lyons is president of the Central Ice Company. According to the draft of the ordinance, the Lyons syndicate proposes to furnish electricity for the district bounded by the river, the state line, Thirty-first street and Prospect avenue, at the rate of four cents per kilowatt-hour to consumers using up to 5,000 kilowatt-hours per month; at six cents for those using not less than 3,000 kilowatt-hours; at seven cents for those using not less than 2,000 kilowatt-hours, and at the rate of eight cents to all others, with ten per cent added after bills are due. The draft also provides that the company shall bury all wires within the district bounded by Second and Eighteenth, Jefferson and Forest, the wires to be on poles throughout the rest of the district which it is proposed to supply with electricity. Mr. Lyons states that he is backed by Eastern capitalists, and that the initial cost of the plant will be between $1,500,000 and $2,500,000. All the necessary apparatus is said to have been arranged for.

ILLINOIS TUNNEL TELEPHONE FRANCHISE LEASED—Independent interests claiming to operate 600,000 more instruments than the Bell company in northern, central, southern, western and southwestern states have, it is stated, completed arrangements to lease the telephone franchise of the Illinois Tunnel Company, Chicago, Ill. They assure substantial reduction of local and long-distance rates and guaranteed to install 100,000 local connections. Four corporations have been organized for the purpose of developing the franchise of the tunnel company and establishing long-distance connections with systems operated by the associated independent interests in the principal cities of the country. The parent corporation, the one which will assume active control of the local situation, is to be named the Chicago & Western Telephone Company, and will be headed by E. L. Barber, of Wauseon, Ohio, through whose efforts the agreement between the Illinois Tunnel Company and the independent telephone interests was made possible. The three subsidiary companies, composed of the independent telephone interests in every section of the country, will be known as the Chicago & Eastern, Chicago & Northern, and the Chicago & Southern. In these three companies, associated with Mr. Barber, are Joseph J. Heim, president of the Kansas City Home Telephone Company and the Kansas City Breweries Company; Arnold Kalman, of St. Paul, who was one of the principal promoters of the Kansas City Home and Kinloch Telephone companies; O. C. Snider, vice-president and general manager of the Kansas City Home Telephone Company; J. C. Powers, president of the Louisville Trust Company, Louisville, Ky.; J. M. Shaw, of S. B. Russell & Company, New York; Jarvis & Conkling, New York city, bankers, and owners of the Havana (Cuba) Telephone Company.

NEW MANUFACTURING COMPANIES.

NEW YORK, N. Y.—Hoyt & De Mallie, Incorporated, has been organized to manufacture electric vehicles, with a capital of $75,000. The incorporators are P. V. Hoyt, J. M. De Mallie, New York city; C. A. Wilson, Passaic, N. J.

NEW YORK, N. Y.—The Empire Gas Fixture Company has been incorporated to manufacture gas and electric fittings. The capital is $10,000, and the incorporators: L. Schaffer, J. Sirken and L. Sirken, all of New York city.

ALBANY, N. Y.—The Mohawk Electrical Company has been incorporated by E. H. Rollinson, M. B. Rollinson, and H. Hendrickson, of Albany, to manufacture mechanical devices and appliances. The company is capitalized at $10,000.

AUGUSTA, ME.—The Warren Electric Manufacturing Company has been incorporated to deal in machinery of all kinds. The capital is placed at $175,000, and the officers are: president, M. M. Spinney; treasurer, E. J. Pike, Augusta.

HARTFORD, CT.—The Empire Electric Manufacturing Company has been incorporated to manufacture, sell and deal in electrical appliances of all kinds. The incorporators are James J. Murphy, Mark J. Hanlon, John L. Bonee, of Hartford, and Harry E. Propson, Plainville. The capital is $5,000.

TELEPHONE AND TELEGRAPH.

MEDIA, PA.—The Bell Telephone Company has completed and placed in operation its new telephone exchange. The cost of the work was about $68,000.

ALTON, ILL.—The Bell Telephone Company is building a new line from Alton to St. Louis, Mo., and will not hereafter have a joint line of poles with the Postal Telegraph Company.

FINDLAY, OHIO—At the annual meeting of the Arcadia Mutual Telephone Company the following officers were elected: president, G. W. Dick; vice-president, C. W. Bricker; secretary, A. L. Anderson; treasurer, E. E. Bish.

PHILADELPHIA, PA.—At the annual meeting of the Bell Telephone Company, of Philadelphia, stockholders, the present board of directors, with the exception of Gen. E. T. Meany, who was succeeded by H. A. Richardson, was reelected.

SPRINGFIELD, MASS.—The New England Telephone Company has petitioned the selectmen of Leyden for the right to extend its lines on all the streets in the town. The company plans to build about six miles of line in the town at once.

JACKSONVILLE, FLA.—The Postal Telegraph Company has placed in operation its line between Jacksonville and Tampa. The distance between the two cities is 240 miles, and the line taps St. Augustine, Palatka, Sanford, Orlando, Lakeland, Plant City and other towns.

TWIN BRIDGES, MONT.—The several telephone lines owned and operated by the farmers of the Madison valley are to be merged and operated as one system. An exchange will be installed at Jeffers, the most central point of the valley. Besides offices in almost every ranch house in the valley, there will be offices in Virginia City, Pony and Norris.

BOONEVILLE, MISS.—The Booneville Telephone Company has submitted to the railroad commission for its information and approval, to become immediately effective, its schedule of charges adopted for public service. Charges for business telephones will run from $2.75 to $1.50, and for residence, $1.50 to $1.00, the minimum being a party-line rate.

PLATTSMOUTH, NEB.—The Plattsmouth Telephone Company expects soon to have a line to Sioux City by way of South Omaha. It expects also to have several toll stations in Omaha by spring. At the recent meeting of the company it elected the following officers: president, Tom E. Parmele; vice-president, Charles C. Parmele; secretary, J. N. Wise; treasurer and general manager, T. H. Pollock; auditing committee, George L. Farley, Edwin Jeary and C. E. Mockenhaup.

CARSON CITY, NEV.—The Pacific Telephone and Telegraph Company will assume control of the Southern Nevada Telephone and Telegraph Company, which circles the mining camps of Southern Nevada. When the Pacific States Telephone and Telegraph Company combined with the Sunset Telephone and Telegraph Company a bond issue was provided for the improvement of the company's holdings and for the purchase of new plants. The purchase of the Nevada company is the first of these proposed extensions. At present the Pacific Telephone and Telegraph Company has no communication with the mining districts, but a direct wire will immediately be installed to Goldfield. The Southern Nevada Telephone and Telegraph Company stock is held principally by Malcolm MacDonald, president of the company; Key Pittman, vice-president of the company; W. Y. Williams and D. G. Doubleday.

ALBANY, N. Y.—At a meeting of the United Message Company, which will eventually control all the independent long-distance telephone lines in the state, Major James M. Andrews, of Schenectady, was elected a member of the board of directors. Following are the officers: president, Theodore M. Brush, Elyria, Ohio; first vice-president, Irving H. Griswold, Elyria, Ohio; second vice-president, Howard Hendrickson, Albany; secretary and treasurer, George H. Rhymers, Albany. All the officers of the Message company, with the exception of Mr. Rhymers, are directors of the local company. The company has holdings throughout the eastern part of the state, as well as in various other portions of New York and in Vermont. Five of its directors are from Elyria, Ohio. A director states that the company will eventually acquire the securities of the independent companies, but at present will give its whole attention to the building up of lines thus far acquired.

ELECTRIC LIGHTING.

COLUMBUS, OHIO—The council has authorized the board of service to invite bids for an addition to the working capacity of the electric light plant. The addition will cost about $90,000. The plant is now very greatly overloaded. The bonds have long been authorized and disposed of.

DENVER, COL.—Negotiations for the purchase of the Gilpin Light and Power Company, at a cost of $700,000, have virtually been closed by the Colorado Central Power Company, the organization backed by Myron T. Herrick, former governor of Ohio; Thomas F. Walsh, D. H. Moffat and other capitalists.

ROSEBURG, ORE.—By a deal which was consummated recently the Roseburg water and light systems pass into the hands of a corporation headed by J. L. Kendall and brother, of Pittsburg, Pa. The new owners announce that they will fully carry out the plans for the extensive improvement of the plants outlined by the recent owner.

SOUTH NORWALK, CT.—The fourteenth annual report of the board of electrical commissioners of South Norwalk, for the fiscal year ending January 1, 1907, shows that the income of the electric light plant nearly touched the $40,000 mark, and that the profits were only a few hundred dollars short of $15,000. Of this amount $12,000 was paid on the plant's debt, and the balance was used to extend and improve the service.

LA PORTE, IND.—The sale of the plant of the Michigan City Light and Power Company to C. H. Geist, the owner of the Michigan City & Northern Indiana gas plant, of Michigan City, and a number of gas and electric plants in northern Indiana and in the east, has been announced by Mr. Geist. The deal has been pending for some time. Neither of the parties has given out the amount involved, but the consideration is believed to be in the neighborhood of $150,000.

COLORADO SPRINGS, COL.—Ordinances providing for submitting to a vote of the voters of Colorado City the question of whether the council shall be authorized to erect a municipal light plant in Colorado City, and also for submitting the question of contracting a bonded indebtedness of $30,000 for the construction of said lighting plant, were introduced at a meeting of the Colorado City council. If the ordinances are passed, they will be voted on at the next regular city election, April 2.

ROCK ISLAND, ILL.—Articles of incorporation of the Independent Light and Power Company, which is seeking admission to Davenport, have been filed. The company is capitalized at $600,000, and is authorized to begin its twenty years of corporate existence when $100,000 has been paid in. The object of the company is to build a gas and electric light and power and steam heating plant in the city of Davenport, with an underground conduit system, and to manufacture and sell the products of such a plant. The officers of the company named in the articles are: president, C. J. Von Maur; vice-president, Wilson McClelland; secretary, George M. Bechtel; treasurer, Julius C. Hasler. The board of directors consists of the above and August E. Steffen, I. L. Sears, F. G. Heningbaum, E. S. Ryan, G. F. Burmeister, Frank Balluff and Carl Richter.

BUFFALO, N. Y.—Representing the Economic Power and Construction Company, Herbert P. Bissell has filed with the department of public works a request for permission to lay steam mains and power conduit lines through various streets and avenues in this city. This permission, Mr. Bissell explained in making the request, is asked in accordance with the provisions of the charter of the city and the power and authority granted to the Economic Power and Construction Company by the laws of the state of New York (chapter 459 of the laws of 1893). The charter which the state granted to the Economic Power and Construction Company gives it permission to utilize the streets of this city for the purposes mentioned without consent of the city authorities. Mr. Bissell explained that the request to lay these steam pipes and conduits was asked in compliance with the police regulations, which determine how such work shall be done. For the purpose of carrying on this work, the Economic Power and Construction Company has been financed by the New York Power Securities Company, which has signified its willingness to advance $2,500,000 to start the work.

ELECTRIC RAILWAYS.

OMAHA, NEB.—The Omaha, Lincoln & Beatrice Interurban Railway Company has been granted a right of way through the western part of the city of South Omaha.

AMERICUS, GA.—At a meeting of the city council franchises for the use of certain streets in Americus by the Macon, Americus & Albany Electric Railway were granted.

DECATUR, ALA.—The capitalization of the North Alabama Traction Company, of the Decaturs, is to be increased to $300,000. This increase is for the purpose of extensions and improvements.

HARRISBURG, PA.—A charter has been issued by the state department to the Kennett & Coatesville Railway Company, with a capital of $120,000, to build a trolley line from Kennett Square to Coatesville, a distance of twelve miles. J. Walter Taylor, of Kennett Square, is president of the company.

ELGIN, ILL.—The Elgin & Belvidere Electric Company has opened its new line between the two cities. The opening of this line makes the trip from Beloit to Chicago by trolley complete. Direct connections will be made at the changing points, Rockford, Belvidere and Elgin.

WATERTOWN, N. Y.—At a meeting of business men of Watertown and vicinity a new railroad company, to be known as the New York Northern Railway Company, was organized with Foster P. Shines, of Watertown, president. The object of the company is to construct an electric railroad from Watertown to Oswego, where it will connect with the Ontario & Western and the Lackawanna railroads.

MANSFIELD, OHIO—At a meeting of stockholders of the Mansfield & Wooster Interurban Railway Company a new board of directors was elected as follows: Samuel Kinsey, Pittsburg; David Collier, Wooster; John L. Barr, B. L. Chase, Charles Brumfield, Mansfield; M. M. Van Nest, Wooster; D. Graven, Loudonville; R. H. Critchfield, Shreve. The capital stock was increased from $30,000 to $2,000,000.

LYNCHBURG, VA.—An effort is being made by property owners in Bedford county to secure the extension of the system of the local street railway system to a point on the Tidewater Railway, in Bedford county, twenty-five miles from Lynchburg. The management of the Lynchburg Traction Company has been interviewed by the promoters of the extension and, it is understood, is willing to meet the people of the county who are interested half way.

VICKSBURG, MISS.—Frank and George Houston, who have been granted a franchise for an electric railway through the Vicksburg National Park by act of Congress, which was recently signed by the president, are preparing to take up the various details with the secretary of war. When these details have been arranged the contract for constructing the line will be awarded and work begun. It is the intention of Houston Brothers to begin work early in the spring.

ELLSWORTH, ME.—At the first meeting of the incorporators of the Mt. Desert Transit Company, the incorporation recently organized to build an electric railway from Ellsworth to Bar Harbor, John S. Kennedy, of New York; George B. Dorr, of Boston; Clement B. Newbold, of Philadelphia; Robert Amory, of Boston, and Fred C. Lynam, of Bar Harbor, were elected directors. Mr. Amory was elected clerk of the corporation, and Mr. Lynam secretary. It was voted to issue at par all of the capital stock that had been subscribed—$160,000. A complete set of by-laws was adopted.

CROOKSTON, MINN.—A project is under way for the building of an electric line between Crookston and Maple Lake and a franchise for such a line is to be asked from the city in the near future. While the line is primarily for the accommodation of citizens who desire to make summer homes at the lake, it is intimated that it will be pushed to a connection with the Soo near Erskine and that it will be so constructed as to afford shippers a chance to avail themselves of the accommodations afforded by that road, and give this city communication with the territory tributary to the Soo.

WILKES-BARRE, PA.—At the annual meeting of the stockholders of the Wyoming Valley Traction Company officers were chosen as follows: president, J. A. Rigg; secretary and treasurer, T. W. Grockett; directors, J. A. Rigg, William McElvain, Joseph L. Caven, W. S. Bell, S. W. Roebling, W. J. Harvey, W. G. Eno, G. N. Reichard, B. B. C. Calderwood, A. Nesbitt, T. A. Wright. Officers for the Harvey's Lake & Dallas Street Railway are the same with the following directors: J. A. Rigg, B. B. C. Catherwood, Joseph Cavan, W. S. Bell, W. J. Harvey, W. G. Eno, William McElvain and T. A. Wright.

PITTSBURG, PA.—It is said that Pittsburg capitalists are planning to build an interurban electric line from Alliance to Salem, Ohio, and from that point to Youngstown, by way of Canfield. The reported line taps one of the richest districts of the Buckeye state, and would traverse a country through which a number of surveys have been made for proposed trolley lines, none of which have ever reached completion. S. L. Tone, vice-president of the Pittsburg Railways Company, is said to have engaged B. M. French, city engineer of Salem, to make preliminary surveys for the line. The same capitalists are said to be planning a line from Alliance to Akron.

WASHINGTON, D. C.—The annual report of the Washington Railway and Electric Company has been submitted to Congress. It shows that the number of passengers carried was 41,952,715. The average fare per passenger was .0286. The receipts from passengers were $1,200,786. The total receipts from all sources, including income on securities, were $1,645,396. The total expenses of operation and fixed charges were $1,121,775. The surplus for the year was $523,620. This was applied as follows: dividends on preferred stock, at five per cent, $425,000; discount of four per cent bonds, issued in lieu of Metropolitan railroad indebtedness, $35,101; charged to depreciation account, $50,000, leaving a net surplus of $13,519.

ALBANY, N. Y.—The Ithaca & Seneca Falls Interurban Railroad Company, of Ithaca, has been incorporated to operate an electric road fifty-two and one-half miles long in Tompkins, Seneca and Schuyler counties, from Ithaca to Seneca Falls with branches from Willard to Ovid and from Trumansburg to Mecklenburg. The capital is $1,000,000 and the directors are: J. N. Hammond, T. J. Cary, of Seneca Falls, Jacob Rothschild, of Ithaca. The Hornell, Bath & Lake Keuka Railway Company, of Bath, Steuben county, has also been incorporated with a capital of $1,000,000 to operate a street railway forty-six miles long from Hornell to Jerusalem in Steuben and Yates counties. The directors are: F. W. Hastings, W. R. Campbell, W. H. Phillips, Bath.

DOYLESTOWN, PA.—For the second time in a year the property of the Newtown Electric Street Railway Company, which includes twenty-eight miles of track from this place to Bristol, power-house, car barns and three tracts of real estate and franchises, has been sold in foreclosure proceedings brought by the Real Estate Title Insurance and Trust Company, of Philadelphia, which holds a mortgage for $300,000 against the property. It was first bought by H. R. Lewis for $109,500, but he was not prepared with a certified check for $25,000, and the property was put up a second time and purchased by A. J. Speece, of Philadelphia, for $100,000. Mr. Speece stated that Thomas P. Chambers, the president of the company, was interested in the deal. It is believed that the New Jersey & Pennsylvania Traction Company is also interested, as that company has been desirous for some time to get a direct line to Doylestown. As the Newtown road connects with the New Jersey railway, it would then have a direct line from Trenton to Doylestown.

DATES AHEAD.

Railway Signal Association. Chicago, Ill., March 18.

Underwriters' National Electric Association. Annual meeting Electrical Committee, New York city, March 27-28.

Ohio Independent Telephone Association. Annual convention, Columbus, Ohio, March 28.

West Virginia Independent Telephone Association. Wheeling, W. Va., April.

Iowa Electrical Association and Iowa Street and Interurban Railway Association. Clinton, Iowa, April 18, 19 and 20.

Southwestern Gas, Electric and Street Railway Association. San Antonio, Texas, April 18-21.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Railway Telegraph Superintendents' Association. Annual meeting, Atlantic City, N. J., June 19-20.

PERSONAL MENTION.

MR. WALTER SCHROFF, formerly manager of the Bell telephone exchange at Weiser, Ida., has been appointed manager of the entire system in the northern part of Washington county. The company intends to make extensive improvements there during the coming summer.

MR. O. H. ENSIGN, of Los Angeles, Cal., has been designated as chief electrical engineer of the United States Reclamation Service. He is a native of New York, and is forty-four years old. After a two years' course in mechanical arts at Cornell, he was employed in a number of machine shops, and later by the New York Edison Company, in New York, and by the General Electrical Company, of Schenectady. In 1893 he moved to California and he has since held important positions with electrical and railway companies. Mr. Ensign is a member of the American Institute of Electrical Engineers.

OBITUARY NOTES.

MR. WILLIAM FOSTER, JR., one of the builders of the Sixth and Second avenue elevated railroads, New York city, died of old age recently at his residence, 876 St. Nicholas avenue, New York. He was eighty-three years old. Nine years ago he suffered a stroke of paralysis while working in his office and never recovered from the effects of the shock. In 1874 he became interested with Dr. Gilbert, William R. Garrison, and a man by the name of Navarro in the project of establishing elevated railroads. These men conceived the idea of running elevated railroads, and received from the state a charter for the Sixth and Second avenue lines.

PROFESSOR HENRI MOISSAN, who last December received the Nobel prize for his experiments in the isolation of fluorine, his researches into its nature and his application of the electric furnace to scientific uses, died in Paris, France, on February 20, after an operation for appendicitis. Professor Moissan, who was a noted chemist, was born in Paris in 1852. He studied at the Museum of Natural History and became connected with the School of Pharmacy in 1879. He was later professor of toxicology and of mineral chemistry. He won the Lacaze prize in 1887 for his valuable experiments with fluorine, which he was the first to isolate and liquefy. His most striking success was the artificial production of diamonds by the sudden cooling of molten iron or silver impregnated with carbon (1893-94). More practical was his simplification of the production of acetylene gas. He wrote many articles on the results of his researches.

NEW INCORPORATIONS.

COLUMBUS, OHIO—Fulda Telephone Company, Toledo, Noble county. $750. Incorporators: J. M. Hohman and others.

MONROE, ME.—Monroe & Brooks Telephone Company. $10,000. President, N. E. Webber; treasurer, H. Tibbetts, Monroe.

MADISON, WIS.—The Luddington Telephone Company, Eau Claire. An amendment increasing its capital from $3,000 to $15,000.

ATLANTA, GA.—Sylvester Telephone and Telegraph Company, Sylvester. $2,500. To run lines from Sylvester to Albany, Tifton, Ashburn and Poulan.

TRENTON, N. J.—Kennedy Electric Company, Morristown. $25,000. To operate power-houses and electric light plants. Incorporators: Emil Podlesak, John C. Kennedy and Robert Kennedy.

GUTHRIE, OKLA.—Enid City Railway Company. $500,000. To build and operate five miles of street railway in the city of Enid. Incorporators: J. J. Hall, Albert Emanuel and Charles H. Porter, of Dayton, Ohio; Carl Rouse and W. H. Ellis, of Enid.

MONTGOMERY, ALA.—The Tallapoosa Development Company. $50,000. To develop water power and transform it into electrical energy. Incorporators: Hubert H. Ward, Cleveland, Ohio, president; W. P. Putnam, Detroit, Mich., vice-president; Fred S. Ball, Montgomery, Ala., secretary and treasurer.

HARRISBURG, PA.—Perry County Telephone and Telegraph Company. To operate in the towns of Bloomfield, Elliottsburg, Greenpark, Loysville, Landisburg, Shermansdale, Centre, Bridgeport, Falling Springs, Andersonburg, Blain, New Germantown and Ickesburg, all in Perry county. $6,000. Incorporators: D. H. Sheibley, L. M. Shumaker, C. B. Kennedy, Spring township; J. C. Waggoner and R. J. Makibbin, Tyrone township.

ELECTRICAL SECURITIES.

But little business was accomplished in the stock market, the last day's session being dull and irregular, and mainly with declines. The market closed on Thursday, effecting a three days' holiday for the first time since 1901. The stiffening tone of the money market was a feature which affected sales considerably, the rates for call money going to five and one-quarter per cent.

ELECTRICAL SECURITIES FOR THE WEEK ENDING FEBRUARY 23.

New York:	*Closing.*
Allis-Chalmers common	14½
Allis-Chalmers preferred	37
Brooklyn Rapid Transit	72⅜
Consolidated Gas	137⅜
General Electric	158½
Interborough-Metropolitan common	33⅜
Interborough-Metropolitan preferred	70½
Kings County Electric	140
Mackay Companies (Postal Telegraph and Cables) common	73¾
Mackay Companies (Postal Telegraph and Cables) preferred	70⅛
Manhattan Elevated	143⅝
Metropolitan Street Railway	104
New York & New Jersey Telephone	114¼
Western Union	82⅞
Westinghouse Manufacturing Company	150

Directors of the Consolidated Gas Company have declared the regular quarterly dividend of 1 per cent on the capital stock. The dividend is payable March 15. Books closed February 26 and will reopen March 16.

Boston:	*Closing.*
American Telephone and Telegraph	127¾
Edison Electric Illuminating	220
Massachusetts Electric	68
New England Telephone	122
Western Telephone and Telegraph preferred	77

The board of gas and electric light commissioners has granted authority to the Edison Electric Illuminating Company, of Boston, to issue 24,200 shares of new capital stock, the proceeds to be applied towards payment of outstanding promissory notes and the cost of additions to its plant. To pay off promissory notes, $348,000 is to be used and $1,773,200 for additions to the plant. The board places the market value of the shares at $215 per share.

Philadelphia:	*Closing.*
Electric Company of America	10
Electric Storage Battery common	63
Electric Storage Battery preferred	63
Philadelphia Electric	8⅜
Philadelphia Rapid Transit	21
United Gas Improvement	92¾

Chicago:	*Closing.*
Chicago Telephone	117½
Chicago Edison Light	140
Metropolitan Elevated preferred	69½
National Carbon common	84
National Carbon preferred	115¼
Union Traction common	—
Union Traction preferred	—

The report of the National Carbon Company for the year ended January 31, 1907, has been published. The income account is as follows: net earnings, $951,078; preferred dividend (seven per cent), $315,000; balance for common, $636,078; common dividend (four per cent), $220,000; balance, $416,078. There was allowed for depreciation the sum of $375,000, and $1,966 was charged off, leaving a surplus of $39,112, which, added to the previous surplus of $395,583, makes the total surplus $434,695, compared with $395,583 for the previous year. The condensed balance sheet of the company places the total assets at $10,725,015, and the liabilities at $10,290,320, leaving a profit and loss surplus of $434,695.

INDUSTRIAL ITEMS.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., will hereafter act as distributors for "Buckeye" class "A" lamps and the new "Buckeye Gem" lamps.

W. S. BARSTOW & COMPANY, New York city, has recently opened a Montreal, Canada, office, in the Bank of Ottawa Building. This office will be in charge of Robert S. Stangland.

THE SIMPLEX ELECTRICAL COMPANY, 110 State street, Boston, Mass., manufacturers of insulated wires and cables, has ready for distribution a new edition of the "Simplex Manual."

THE GRAY TELEPHONE PAY STATION COMPANY, Hartford, Ct., has published a handsome catalogue devoted to its automatic toll equipments. This catalogue will be sent to any one interested upon request.

THE GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., has published a handsome catalogue devoted to fans, blowers, and exhausters for all purposes. This catalogue will be sent to any one interested upon request.

SCHUTTE & KOERTING COMPANY, Twelfth and Thompson streets, Philadelphia, Pa., announces that Ernst Koerting, the well-known inventor of the Koerting injector, has bought the entire interest in the Schutte & Koerting Company.

THE DIELECTRIC COMPANY OF AMERICA, Belleville, N. J., is mailing an attractive "good luck" postal card calling attention to the merits of the "DE" weatherproof wires. Samples and prices, it is stated, will be sent to those interested, on application.

THE UNIVERSAL ELECTRIC STAGE LIGHTING COMPANY, Kliegl Brothers, proprietors, 1393 Broadway, New York city, has published a very interesting catalogue devoted to electric stage lighting apparatus and effects, electric signs and illuminations.

THE PHELPS COMPANY, Detroit, Mich., is publishing an attractive little pamphlet, called the "Hylo Magazine." This gives a good deal of interesting material concerning the various Hylo products, including turn-down lamps, thermal flashers, skeedoodles, and advertising devices.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has published a very interesting and instructive booklet entitled, "The Horse." The contents of the booklet cover a wide range of information, and should be of great practical interest to all owners of horse-drawn vehicles. The utilization of Dixon's graphite axle grease is referred to briefly.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, is distributing its usual souvenir calendar. This is one of the most attractive art calendars of the season. At the same time the "moonlight schedule" for 1907, which forms part of the calendar, makes it of real practical value to central stations and others interested in the use of this company's products.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., in bulletin No. 1044, describes and illustrates the H. Ward Leonard system of multiple voltage control for variable-speed motors. This bulletin has been very carefully prepared, and in addition to the half-tone illustrations of typical applications of this system, there are several line diagrams showing the wiring connections.

THE MONARCH ELECTRIC MANUFACTURING COMPANY, Warren, Ohio, is distributing a series of advertising literature calling attention to the Monarch lamp and Monarch "Prismo" clusters. A neat advertising conceit which the company is now distributing is entitled, "The Tale of Two Jacks." This details the advantages of making a liberal use of this company's products.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has opened a sales office in the Candler Building, Atlanta, Ga. This office will be in charge of Harold H. Seaman. Mr. Seaman was formerly engineer of the Cleveland sales office of the company, and his experience gained there will enable him to handle promptly and efficiently all matters pertaining to the territory of Tennessee, North and South Carolina, Georgia, Florida, Alabama and Mississippi.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, 170 South Clinton street, Chicago, Ill., announces that it has discontinued its St. Louis office. G. A. Knoche, who has been the company's representative in the Southwest, has resigned this agency to accept a position immediately with the National Metal Molding Company, in charge of its New York office. Mr. Knoche has been representing several companies in the Southwest, with headquarters at St. Louis. The territory formerly covered by Mr. Knoche will be taken care of from the Chicago office. A few weeks ago the Chicago Fuse Wire and Manufacturing Company secured the services of J. J. Schaller to represent it as traveling salesman through the western, southern and central states, with headquarters in Chicago. Mr. Schaller has had several years of valuable experience in the electrical field as salesman for large jobbing houses, namely, Albert Smith, Milwaukee, Wis.; Manhattan Electrical Supply Company and American Electrical Supply Company, Chicago, Ill.

THE INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY, Yonkers, N. Y., has just issued a new price book on "Habirshaw" wires and cables. This book is replete with valuable and interesting information. Some of the features are tables giving the calculations for extra braids, cotton or paper-wrapping, thirty per cent Para compound, flexibles and lead coverings. There is also given a synopsis of wiring rules, a comparison of copper gauges, and bar prices from seventeen cents to twenty-eight cents, inclusive. A new feature which will be of considerable value to the trade is the list giving code prices on various copper bars. In the past, when prices have fluctuated, with each advance it has been necessary to produce a new list of prices representing the prevailing bar. This has frequently involved delays in sending out quotations to customers. With this new book it will be easy to secure a reference for the latest code price, obviating any delay. The company has a large supply of these books on hand, and will be pleased to forward copies to any one interested upon request.

Record of Electrical Patents.

Week of February 19.

844,314. APPARATUS FOR REGENERATING ELECTROLYTES. Leo. H. Baekeland, Yonkers, N. Y., assignor to Development and Funding Company, New York, N. Y. A regenerative apparatus comprising regenerating tank, circulating system and brine support.

844,317. TRIMMING DEVICE FOR LOADING APPARATUS. Sherman J. Blake, Conneaut, Ohio. A motor-driven chute and rotatable telescopic elbow.

844,321. LOCK FOR INCANDESCENT LAMPS. Jerome F. Boyer, Pittsburg, Pa. A wire locking the lamp socket to the lamp bulb or globe.

844,345. ELECTRIC TIME-SWITCH. Malon I. Flowers, Lincoln, Ark. A time-switch with strike mechanism and device for making predetermined indications.

844,352. CONTROLLER FOR ELECTRIC MOTORS. Harry U. Hart, Le Havre, France, assignor to Westinghouse Electric and Manufacturing Company. Two or more electric motors with armature and field magnet windings normally in series, and electrically operated braking device.

844,353. CIRCUIT-BREAKER. Frank O. Hartman, Mansfield, Ohio. A circuit-breaker with a plurality of stationary terminals, a movable bridge contact engaging terminals, and a supporting means moving the bridge.

844,361. ELECTRIC ARC LAMP. Franz Janecek, Karlin, near Prague, Austria-Hungary. An electric arc lamp, one carbon of which is furnished with a series of projecting pins engaging in a ring-supporting device.

844,379. ELECTRIC CONTROLLER. Edwin Marshall, Warrensburg, Mo. An electric controller combining a casing, resistance coil and contact buttons.

844,383. ELECTRIC MOTOR. Charles R. Meston and Herbert I. Finch, St. Louis, Mo., assignors to the Emerson Electric Manufacturing Company, St. Louis, Mo. An electric motor with the armature loosely mounted on armature shaft, the armature consisting of driving elements and a clutch.

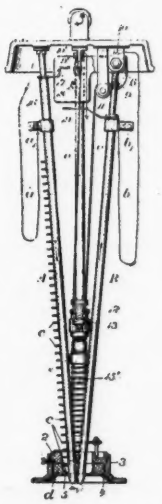
844,384. ELECTRIC MOTOR. Charles R. Meston and Herbert I. Finch, St. Louis, Mo., assignors to the Emerson Electric Manufacturing Company, St. Louis, Mo. An electric motor with the armature loosely mounted on the armature shaft, a clutch device effecting changes of speed.

844,399. RAIL-JOINT. Ephraim M. Porter and John W. Daubenspeck, Kellettville, Pa. A rail-joint having the web portion provided with reenforcements, part of the reenforcements being cut away to form an auxiliary web, and recessed to receive the end of a supporting lever.

844,406. ELECTRIC TRIMMING APPARATUS. Felix J. Rush, New York, N. Y. An electric trimming apparatus making use of the heat from a conducting filament, whereby the latter may be heated for singeing purposes.

844,436. METERING AND CONTROLLING SYSTEM FOR ELECTRIC CIRCUITS. James J. Wood, Fort Wayne, Ind. A combination of an electric motor, a customer's circuit, a relay switch for opening and closing the customer's circuit, a means for recording a predetermined amount of electric energy, and means for applying to the meter a portion only of the energy expended in the customer's circuit to operate the meter.

844,439. ARC LAMP. John H. Bennett and Adrian I. Miner, San Francisco, Cal. An arc lamp containing a brass tube and a two-part carbon clutch of magnetic material arranged within the tube.



844,361.—ELECTRIC ARC LAMP.

844,450. RECTAL DILATOR. Charles R. Harris, Los Angeles, Cal. A dilator comprising a metallic shell with an oval forward projection containing a removable battery projecting into the cylindrical portion of the shell.

844,495. SPARK-PLUG FOR EXPLOSIVE ENGINES. Arthur R. Bullock, Cleveland, Ohio, assignor to Excelsior Spark-Plug Company, Cleveland, Ohio. A jump-spark plug for explosive engines, the body part having ports which lead from its internal cavity to an exterior face of an adjustable collar.

844,506. TELEPHONE TRUNKING SYSTEM. Francis W. Dunbar, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A trunk circuit extending between different switchboard sections, and adapted to connect telephone lines together for conversation.

844,533. ELECTRIC LIGHT SWITCH. James McGavock, Denver, Colo., assignor to the New England Electric Company, Denver, Colo. A spring-controlled, rocker-arm, push-button switch.

844,572. ELECTRIC BELT. Richard Wingren, Burlington, Kans., assignor to the Electric Appliance Company, Burlington, Kans. A regulator for electric belts.

844,578. SPARK COIL. John F. Cavanagh, Providence, R. I. A spark coil entirely enclosed in a case, with a bore longer than the core, and forming an annular space around the core.

844,605. ELECTRIC LIGHTING DEVICE FOR LAMPS AND OIL STOVES. Svend M. Meyer, New York, N. Y., assignor to George C. Batcheller, New York, N. Y. A lighting device for lamps and oil stoves, making a combination with the wick tube and a cylindrical shell or casing surrounding the wick tube.

844,610. ELECTRIC CIGAR-LIGHTING APPARATUS. Svend M. Meyer, New York, N. Y., assignor to George Clinton Batcheller, New York, N. Y. An electric torch having a combination of conducting rods, resistance coils and a capillary body carrying an inflammable liquid.

844,611. ELECTRIC LIGHTING APPARATUS FOR INCANDESCENT AND OTHER GAS LAMPS. Svend M. Meyer, New York, N. Y., assignor to George Clinton Batcheller, New York, N. Y. An incandescing lighting coil made up of a plurality of separate wires.

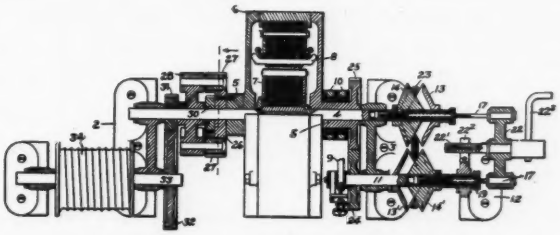
844,630. SPEED CONTROLLER FOR ELECTRIC MOTORS. Robert Temple, Denver, Colo. A speed controller with separated insulating contact plates provided with contact device manipulated by a rotatable arm mounted between the plates.

844,650. ALTERNATING-CURRENT RETAINING DEVICE FOR ELECTRIC-MOTOR CONTROLLERS. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. An alternating-current supply circuit associated with an alternating-current motor and resistance, a movable element for controlling the resistance, and a retaining magnet responding to an alternating current for holding the movable element in a predetermined position.

844,651. DRUM CONTROLLER FOR ELECTRIC MOTORS. Thomas E. Barnum, Milwaukee, Wis. A rotatable member with contacts arranged cylindrically thereon, resistance terminals adapted to be engaged by the said contacts, one set of terminals being connected to an armature resistance, the other set being connected to a field resistance.

844,652. THREE-WIRE REVERSIBLE-DRUM CONTROLLER. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. A motor controller in combination with a rotatable member carrying contacts arranged to be rotated in either direction from an initial position, combined with a rotatable member carrying contacts and connecting the motor either with a high-voltage or low-voltage source of electrical energy.

844,661. CLUTCH-CONTROLLED ELEVATOR. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. A combination of an elevator mechanism with a driving element capable of running independently thereof, a magnetic clutch whose driving member is accelerated through the combined influence of induction and friction.



844,748.—SPEED-CHANGING DEVICE.

844,662. ELECTRICALLY CONTROLLED SKIP-HOIST. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. A combination with a driving mechanism, of a driven mechanism, a clutch for connecting the same having a member driven at a relatively slow speed, and a member driven in the same direction at a relatively high speed, and automatically operated means for causing the operation of the driven mechanisms, respectively.

844,663. SELF-STARTER FOR ELECTRIC MOTORS. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. A combination with a motor of a plurality of controlling magnets, each of which closes an operating circuit for the next succeeding magnet.

844,701. ELECTRIC MOTOR. Julius B. Wantz, Chicago, Ill., assignor to Victor Electric Company, Chicago, Ill. A starting and stopping switch device for an electric motor, comprising a rotary shaft, a line wire terminal, a normally open contact spring movable into and out of engagement with the terminal, and from which extends a direct armature circuit and a motor field shunt circuit, a ratchet on the shaft, and a dog cooperating therewith, both included in the shunt circuit.

844,743. GUARD FOR STREET RAILWAY CARS. Susie E. Pressler, Toledo, Ohio. The combination with a car body having pivoted front and rear trucks of a fender and guard sections secured to, and movable with, the trucks.

844,748. SPEED-CHANGING DEVICE. John Riddell, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York. A speed-changing device affected by the combination of the main shaft with the armature of an induction motor.

844,755. VENT VALVE FOR BATTERIES. Frank J. Schalow, New York, N. Y. A vent valve for batteries, comprising a thimble-shaped cap screw threaded internally and provided in its opposite side with recesses which extend to the bottom of the sides thereof.

844,777. CONTROL SYSTEM FOR CONNECTING MOTORS AS BRAKING-GENERATORS. Frank E. Case, Schenectady, N. Y. A system of control with an electromagnetic actuating means for a reversing switch, a contact independent of the controller for completing the circuit of the motor, and means for actuating the reversing switch and contact to connect the motor for operation as a braking-generator.

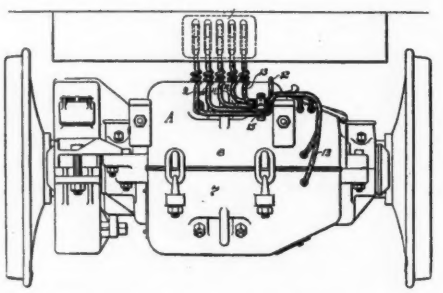
844,778. LUMINANT IN ELECTRIC INCANDESCENT LAMPS. Francis M. F. Cazin, Hoboken, N. J. A luminant for an electric incandescent lamp, being a combination of alloys of metals in layers of higher and lower affinity to oxygen, the latter coated on their exposed surface with their own oxides.

844,787. ELECTRIC SWITCH. Charles E. Eveleth, Schenectady, N. Y., assignor to General Electric Company. A switch contact consisting of a homogeneous mixture of a refractory conductor and an abradant.

844,790. SUPPORT FOR RAILWAY MOTOR-CABLES. Frank W. Garrett, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. A car body and car truck adapted to turn relatively to said body, a motor on said truck, cable leads between the motor and the car body, and a support for the cable leads movable with the truck and located approximately in vertical alignment with the king-pin of the truck.

844,791. COMBINED FUSE AND SWITCH. Henry Geisenhöner, Schenectady, N. Y., assignor to General Electric Company. A switch with a current-carrying fuse in its movable member.

844,792. MECHANICAL EAR FOR TROLLEY WIRES. Edward E. Gilmore, Philadelphia, Pa. A mechanical ear with a pair of jaws, and tongues on each side of the jaws.



844,790.—Support for Railway Motor-Cables.

844,796. INSULATING WIRE-HOLDER. Andrew Hatchett, Louisville, Ky., assignor of one-third to S. I. I. Battiste and one-third to E. S. Porter, Louisville, Ky. An insulating holder having a downwardly and spirally extending bifurcation beginning at the outside shoulder and ending at approximately the centre of the insulator.

844,797. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. A train-operated block-signal system.

844,800. SYSTEM FOR CONTROLLING ELECTRIC SWITCHES. Edward M. Hewlett and Charles E. Eveleth, Schenectady, N. Y., assignors to General Electric Company. A transmission system with means for cutting out any defective conductor, and means for disabling the actuating devices of all the remaining conductors.

844,810. METHOD OF INCREASING THE EFFICIENCY OF ALTERNATING CURRENTS. Isidor Kitsee, Philadelphia, Pa. An arrangement causing one-half of each cycle to flow through one branch of a circuit, the other half to flow through a second branch of the circuit, each branch having a primary of a transformer, and causing the impulses induced in the secondary of each transformer to flow through a consuming circuit.

844,811. TELEPHONY. Isidor Kitsee, Philadelphia, Pa. A telephone line with a series of substations connected in multiple arc, an electromagnetic resistance in series with the circuit of each station, and means to short-circuit the resistance by the removal of the receiver from its hook.

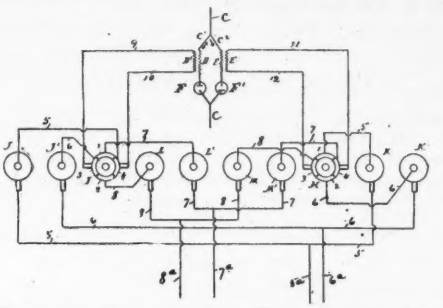
844,815. STORAGE BATTERY. Simon Lake, Bridgeport, Ct. A battery cell formed with laminated walls composed of different materials, comprising inner and outer metallic tanks.

844,829. INCANDESCENT LAMP SOCKET. Johann G. Peterson, Bridgeport, Ct., assignor to the Bryant Electric Company, Bridgeport, Ct. A socket with an angle projection on the inner face of the cap rim, and a corresponding hole in the shell.

844,839. TELEPHONE ATTACHMENT. William R. Whitehorne, Bethlehem, Pa., assignor to Howard C. Bailey, Philadelphia, Pa. An apparatus for producing an abnormal sound in the receiver of any telephone instrument left off the receiver hook, and capable of being actuated by the subscriber.

844,878. MEANS TO INCREASE THE EFFICIENCY OF ALTERNATING CURRENTS. Isidor Kitsee, Philadelphia, Pa. A circuit connected to a source of alternating current, and divided to provide a plurality of branches, and means associated with each branch to permit the flow of current in one direction, and to prevent the flow of current in the opposite direction.

844,918. CAR-MAGNET SUPPORT. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. A magnet-supporting frame for a surface-contact railway system.



844,810.—Method of Increasing the Efficiency of Alternating Currents.

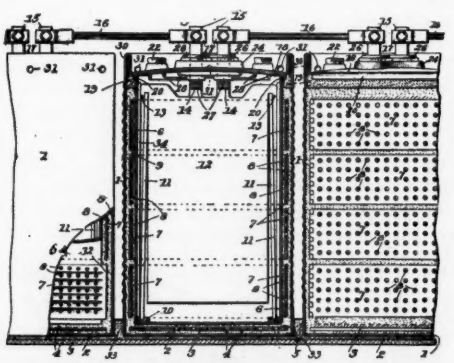
844,961. CIRCUIT-BREAKER FOR ELECTRICAL CONDUCTORS. William C. Shaw, White Plains, Md., assignor to John M. Boarman, Faulkner, Md. A combination of a pair of make-and-break sections moving laterally into and out of contact with each other.

844,979. ELECTRIC HEATER. Edwin R. Waterman, San Francisco, Cal. An electric heater provided with an outer cylindrical shell, a central liquid-containing receptacle, and having an inlet and outlet connected to the receptacle in combination with a sectional electric heating device.

844,989. DEFLOCCULATED GRAPHITE AND PROCESS OF DEFLOCCULATION THEREOF. Edward G. Acheson, Stamford township, Welland county, Ontario, Canada. Deflocculated graphite comprising unctuous graphite treated with a deflocculating agent.

844,997. PHASE-SPLITTER AND CLUTCH. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. A combination of a motor, a phase-splitter having a plurality of resistances of different character, a magnetic clutch, and a plurality of independently actuated switches controlling the resistances and the clutch.

845,010. ELECTRICAL PROTECTIVE APPARATUS. Charles A. Rolfe, Rochester, N. Y., assignor to Rolfe Electric Company, Rochester, N. Y. A lightning arrester comprising ground-corbons, line-carbons and a mass of insulating heat-susceptible material.



844 815.—Storage Battery.

845,023. SYSTEM OF CONTROL. Harold E. White and Harold C. Pease, Schenectady, N. Y., assignors to General Electric Company. A combination of a controller, a governing relay, a controlling circuit and a master controller.

845,024. CONTROLLER. Harold E. White, Schenectady, N. Y., assignor to General Electric Company. A controller comprising a casing containing a nest of resistance coils, a member provided with a series of contacts in electrical connection with the resistance coils, and a contact finger carried by the movable controller member and arranged to engage the contacts of the coils.

845,034. SAFETY DEVICE FOR OVERHEAD ELECTRIC CONDUCTORS. Emile Giraud, Paris, France. A device comprising a lever pivoted to the insulator of the conductor, a hanger carried by an axis fixed to one end of the lever and engaging the conductor.